

4692

COLOR GRAPHICS COPIER

*Please Check for
CHANGE INFORMATION
at the Rear of This Manual*

0541-13

WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

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MANUAL REVISION STATUS

PRODUCT: 4692 Color Graphics Copier

This manual supports the following versions of this product: Serial Numbers B010100 and up.

REV DATE	DESCRIPTION
NOV 1984	Original Issue

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OPERATORS SAFETY SUMMARY

This general safety information is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

TERMS

IN THIS MANUAL

CAUTION statements identify conditions or practices that can result in damage to the equipment or other property.

WARNING statements identify conditions or practices that can result in personal injury or loss of life.

AS MARKED ON EQUIPMENT

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

SYMBOLS

IN THIS MANUAL



This symbol indicates where applicable cautionary or other information is to be found.

As Marked on Equipment



DANGER high voltage.



Protective ground (earth) terminal.



ATTENTION — refer to manual.



Refer to manual.

POWER SOURCE

This product is designed to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

GROUNDING THE PRODUCT

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the power input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

DANGER ARISING FROM LOSS OF GROUND

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

USE THE PROPER POWER CORD

Use only the power cord and connector specified for your product.

Use only a power cord that is in good condition.

Refer cord and connector changes to qualified service personnel.

USE THE PROPER FUSE

To avoid fire hazard, use only the fuse specified in the parts list for your product, and which is identical in type, voltage rating, and current rating.

Refer fuse replacement to qualified service personnel.

OPERATORS SAFETY SUMMARY

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

To avoid explosion, do not operate this product in an atmosphere of explosive gases unless it has been specifically certified for such operation.

DO NOT REMOVE COVERS OR PANELS

To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

SERVICE SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

DO NOT SERVICE ALONE

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

USE CARE WHEN SERVICING WITH POWER ON

Dangerous voltages may exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing the power supply shield, soldering, or replacing components.

DO NOT WEAR JEWELRY

Remove jewelry prior to servicing. Rings, necklaces, and other metallic objects could come into contact with dangerous voltages and currents.

POWER SOURCE

This product is intended to operate from a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

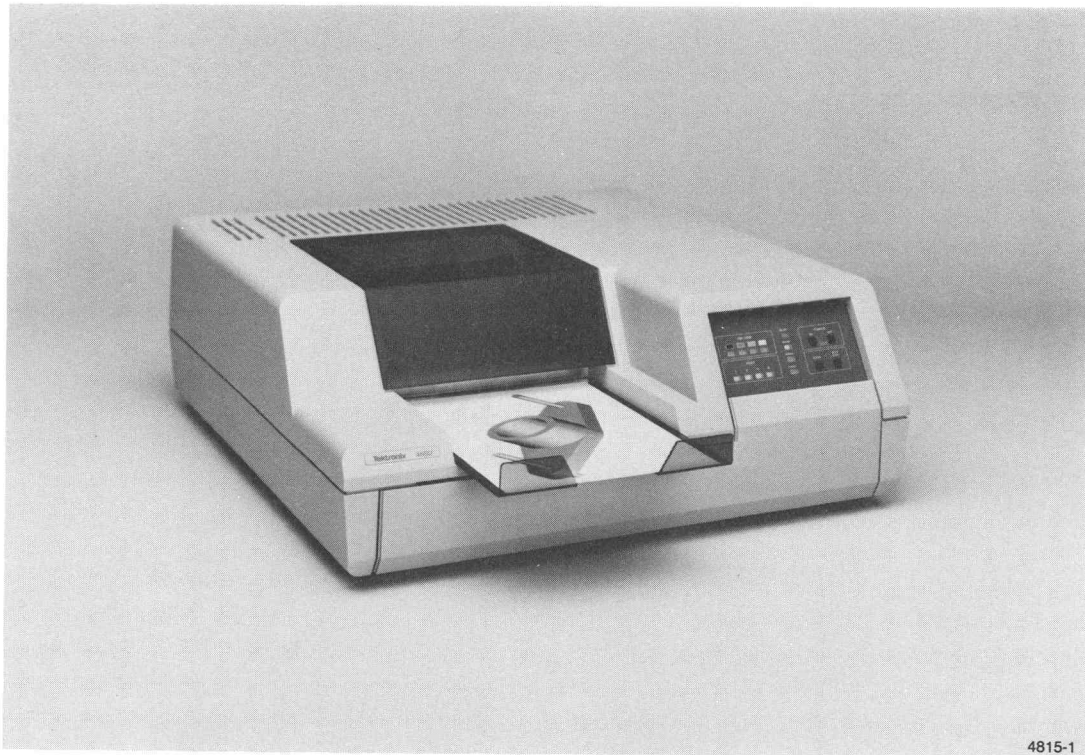


Figure 1-1. 4692 Color Graphics Copier.

GENERAL INFORMATION

The general topics covered in this section are:

- Introduction to this manual
- Related Documentation
- Product Overview
- Copier Compatibility

1.1 INTRODUCTION

This manual contains all the necessary information for an in-depth, detailed technical understanding of the TEKTRONIX 4692 Color Graphics Copier (hereafter called "copier"). The manual is organized to facilitate servicing the copier in the field. The following is an overview of the manual contents and organization.

Section 1, *General Information*

This section contains general information about:

- The manual contents and related documentation
- The copier (a general overview)
- Copier compatibility considerations

Section 2, *Problem Identification and Performance Checks*

This section provides a sequence of procedures that allow the field service technician to quickly isolate a problem and replace the faulty component or F.R.U. (field replaceable unit). An overview shows this section contains:

- Interpretation of the Front Panel Indicators including the FAULT (error codes). The error codes are divided into operator error codes and extended error codes.
- Test Procedures for General Problem Identification
 - Is the problem mechanical or electrical?

If mechanical, is it:

- Air handling system
- Ink delivery system
- Media handling system
- Carriage movement/control system

If electrical, is it:

- Power Supplies
- Process Control board
- Drive Module board
- Parallel Interface board
- Front Panel board
- Cabling connections

- Verifying the copier performance. After all copier systems are checked and adjusted (if necessary), the internal test patterns (TEST mode) and service routines (SERVICE mode) provide feedback about the copier systems operation.

Section 3, *Theory of Operation*

This section discusses the detailed electronic design which handles the image data and controls the internal copier systems. It then describes the mechanical and fluid system which make color ink-jet printing possible.

Section 4, *Copier Maintenance*

When a copier has produced 2000 copies, or three months time has passed since the last service was performed, it is time to check the function of all the copier systems, and perform required maintenance.

A "key operator" can perform all needed maintenance at the three month/2000 copy interval. Copier maintenance by a qualified service technician is recommended once every year or 5000 copies, whichever comes first.

Section 5, *Checks and Adjustments*

The information in this section covers procedures for checking and adjusting:

- Air pressure
- Media Input Tray
- Carriage Drive Belt
- Fluffer/Paper Position
- Head Maintenance Station
- Power Supplies (checks only)
- Ink-jet Head Performance

Section 6, *Mechanical Disassembly/Assembly Procedures*

This section is organized in the order which the assemblies are removed from the copier. These procedures are illustrated to ensure clear interpretation of the step-by-step procedures.

Sections 7-9, *EPL, Diagrams and Schematics, and MPL*

These sections include:

- The electrical parts list (EPL),
- System and circuit board block diagrams and schematics,
- Exploded mechanical illustrations accompanied by detailed mechanical parts lists (MPL).

Appendices

The information in the appendices include:

- Appendix A, *Accessories and Supplies*
- Appendix B, *Copier Options*
- Appendix C, *Moving or Storing the Copier*
- Appendix D, *Installing the Copier*
- Appendix E, *Jumpers and Parallel Interface Termination*
- Appendix F, *Interface Connector and Protocol*
- Appendix G, *Firmware and Memory Locations*
- Appendix H, *Major Signals*
- Appendix I, *Specifications*
- Appendix J, *Error Codes*
- Appendix K, *Color Test Patterns*

1.2 RELATED DOCUMENTATION

In addition to this Service Manual, the following documents support the TEKTRONIX 4692 Color Graphics Copier:

- *Operators Guide* (a label located inside the copier's consumables access door)
- *4692 Color Graphics Copier Device Driver Development Guide* (a manual that tells how to program a host computer or other signal source to send color information to the ink-jet copier)
- *4692 Color Graphics Copier Operator's Manual* (a manual providing general information and operating instructions)
- *067-1204-00 4692 Threshold Voltage Pattern Generator Test Fixture Instruction Manual* (a manual for a test pattern generator used by the service technician)
- *4510 Color Graphics Rasterizer Operators Manual* (a manual telling how to use the 4510 Rasterizer with the copier)
- *4510 Color Graphics Rasterizer Programmers Reference Manual* (a manual telling what commands to use with your Tektronix Color Graphics Terminal to get the best results from a 4510 rasterizer/copier system)

1.3 PRODUCT OVERVIEW

This overview describes copier features, compatible color terminals, and a physical description of the copier.

The TEKTRONIX 4692 Color Graphics Copier is a high reliability A (or A4)-size ink-jet color copier. The 4692 features air assisted "drop on demand" ink-jet technology to produce sharp, superior image quality. Specially matched paper and transparency media and inks combine to produce excellent color saturation.

1.3.1 COPIER FEATURES

The copier contains the following features:

- The standard copier produces A-size (8.5 x 11 inches — 216 x 279 mm) output. The copier may also be configured to accept A4-size media (210 x 297 mm).
- You can initiate copies from either a color terminal, a hardware rasterizer, or a host computer over a TTL compatible parallel interface.
- Up to four image sources may be connected to the copier at one time if the copier is equipped with the Option 02 (four-channel multiplexer).
- The copier makes copies in portrait (vertical) or landscape (horizontal) format, depending on the image orientation specified by the host terminal or computer. For more information, refer to the *4692 Color Graphics Copier Device Driver Development Guide*.
- The time to produce printed output for a given host resolution is independent of the image complexity or the amount of area filled with color.
- For A-size copy resolution, the copier can print 128 to 154 dpi (dots per inch) in the horizontal and vertical directions. (A4-size resolution is 128 to 159 dpi.)
- The copier produces seven brilliant colors on both paper and transparency media. The background of the printing paper provides an eight color, white. 208 additional shades are available using dot patterns (dithering).
- The ink supply consists of four easily replaceable cartridges, one each for black, cyan, magenta, and yellow.
- Media handling is automatic. The copier loads media from the media input tray by vacuum and automatically stacks the printed sheets in the media output tray. Handling of transparencies with separator sheets is automatic, too.

1.4 COPIER COMPATIBILITY

The use of a simple parallel interface and protocol affords the user a wide variety of compatible or adaptable terminals.

1.4.1 COMPATIBLE COLOR TERMINALS

The copier is compatible to the Option 09 and Option 19 versions of the TEKTRONIX 4115B, M4115B, 4113B, and the 4113B30 Color Graphic Terminals. An existing 4113 or 4113A can be made compatible with the copier by installing Version 6, or greater, terminal firmware and by adding the Option 09 Color Copier Interface Upgrade Kit (4110F09).

The copier is also compatible with the TEKTRONIX 4106, 4107, and 4109 Color Graphic Terminals when they have Version 4 or greater firmware.

Other terminals must have an interface and device driver that is analogous to the Option 09. Information for developing a device driver can be found in the *4692 Color Graphics Copier Device Driver Development Guide*.

1.5 PRODUCT DESCRIPTION

The 4692 copier's cabinet contains a hinged top cover door, a media output tray, a front control panel, a consumables access door, and a rear panel for interface port connector(s), fuse, and the power cord. Opening the consumables access door exposes more controls on the front panel, the four ink cartridges, the media input tray, the maintenance liquid cartridge, and the Operators Guide label.

Internally, the copier contains five major component assemblies — see Figure 1-2.

An outline of the copier systems includes:

THE ELECTRONICS. Consists of the following:

- Five circuit boards: Drive Module, Process Control, Parallel Interface, Interconnect, and Front Panel.
- Head carriage assembly.
- Media handling motors, and solenoids.
- Input power system.

THE INK AND AIR COMPONENTS. Consists of the following:

- The ink cartridges, which provide the four basic ink colors.
- The ink plumbing lines, which provide an ink path from each ink cartridge to its respective ink-jet head.
- The blower motor, which provides suction to hold media to the drum and directed air flow to facilitate media loading.
- The air pump, air regulator, air filters, and air lines, which pressurize the ink cartridges and provide filtered, regulated air to the ink-jet heads.
- The ink-jet head assemblies, which eject inks onto the media as demanded by the copier's electronics.

THE MEDIA TRAYS. The copier features two removable media trays:

- The media input tray stores up to 100 sheets of paper or 50 sheets of transparency film with separator sheets. You may convert the tray to hold either A-size or A4-size media.
- The media output tray (on the top cabinet) collects up to 50 paper copies or 25 transparency copies and 25 accompanying separator sheets.

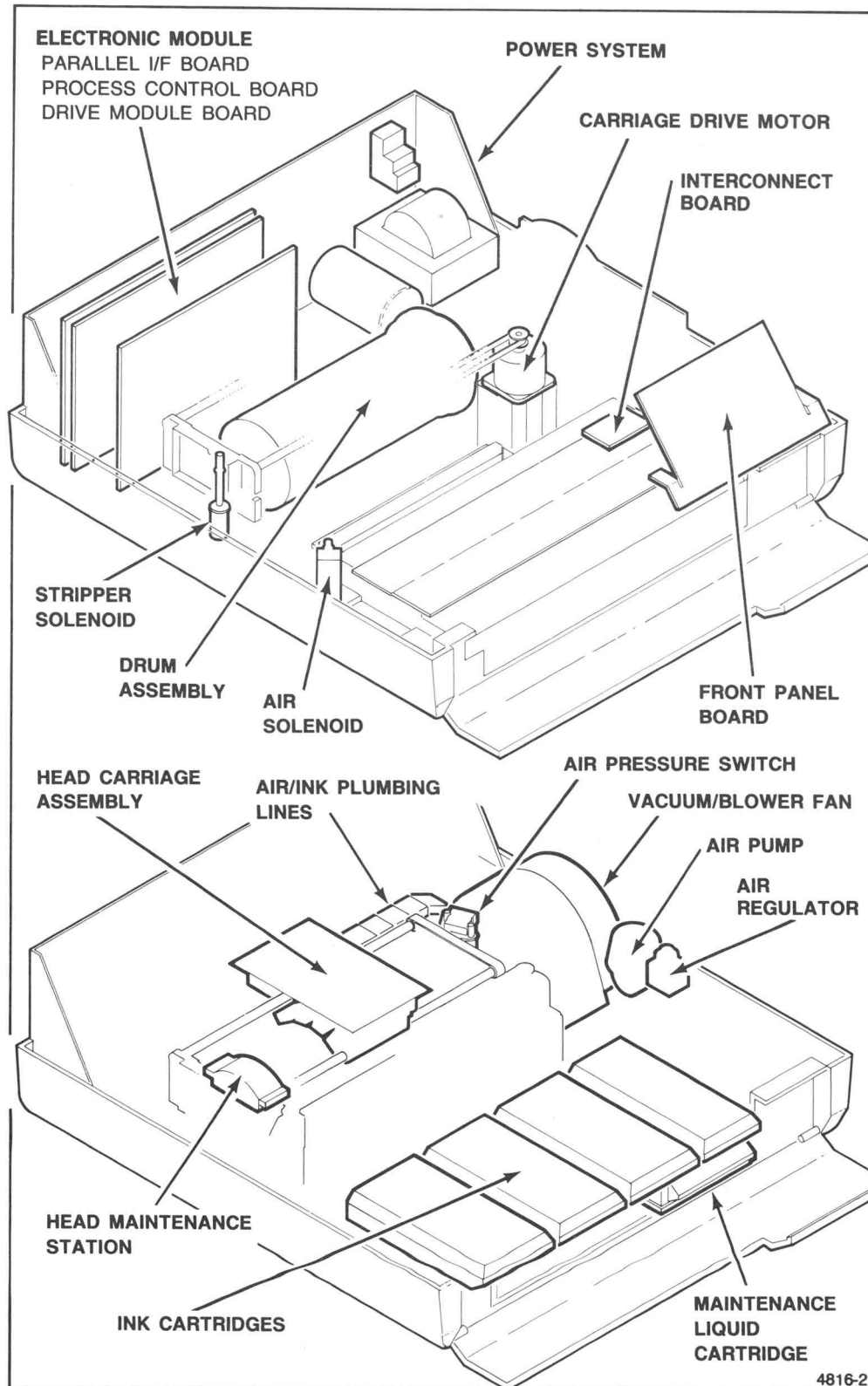


Figure 1-2. Copier's Internal Components.

GENERAL INFORMATION

THE MEDIA HANDLING SYSTEM. Loads, prints, and then transports the printed media to the output tray:

- An air stream moves the media from the media input tray to the stationary drum assembly.
- A vacuum in the drum assembly secures the media to the drum which then begins to rotate.
- The rotating drum spins the media while the head carriage assembly scans across the drum and inks the media.
- The finished copy from the drum is then ejected into the media output tray.

THE HEAD MAINTENANCE SYSTEM. Washes and prepares the ink-jet heads when the copier first powers up, after every 40 copies or 20 hours of operation, and when the copier starts a power-down sequence. The head maintenance system includes:

- The head maintenance station, which washes the ink-jet heads and protects them from drying out.
- The twin compartmented maintenance liquid cartridge supplies a special solution for the head maintenance system. The wash pump draws the clean fluid from the top compartment and flushes the surface of the ink-jet heads to remove ink residues and paper particles. Once used, the dirty solution returns to the bottom compartment of the maintenance liquid cartridge for waste storage.

1.6 COPIER OPTIONS

There are several options available with the copier. Refer to Appendix B *Copier Options*, for more information.

1.7 ACCESSORIES AND SUPPLIES

Refer to Appendix A for a list of the standard accessories (those shipped with the 4692 copier), optional accessories, and supplies needed to operate your copier on a day-to-day basis.

Section 2

PROBLEM IDENTIFICATION AND PERFORMANCE CHECKS

2.1 INTRODUCTION

The information presented in this section allows you (the service technician) to identify copier problems and their solutions in a timely manner. Before troubleshooting the copier, you must understand how the front panel indicators (red, yellow, and green LEDs) display error codes and how to interpret them, and also what the copier modes are and how to use them. A synopsis of the section contents follows:

- Overview of **FAULT** (problem) indicators displayed on the front panel, and what they mean.
- Overview of the three copier modes, and indicator interpretations.
- A flowchart (Figure 2-3) describing an ordered approach for identifying a problem type.
- A breakdown of the **FAULT** code types into five general categories, and identification of the required action.
- One group of problems, titled “No Power Indicator,” does not generate a front panel **FAULT** indication. A step-by-step method of isolating the cause(s) allows the you to quickly identify the faulty component.

2.2 OVERVIEW OF FAULT INDICATORS (FRONT PANEL)

The following instructs you on how to interpret the front panel indicators and lists the error codes.

2.2.1 FAULT INDICATIONS

The red **FAULT** indicator is positioned under the **MEDIA** indicator. The **FAULT** indicator functions in all three copier modes (Normal, Test, and Service).

In Normal and Test mode, the **FAULT** indicator combines with the four **INK LOW** indicators and the four **PORT** indicators to display error codes. The information titled “2.2.2 How the Error Code are Presented” describes how to display and interpret these error codes.

Unlit State

An unlit **FAULT** indicator signals that the copier has no error conditions present.

Lit State

Whenever the FAULT indicator illuminates, you can expect one of the following copier conditions:

- The copier needs simple operator maintenance (such as adding paper or replacing an ink cartridge).
- The copier has a simple problem (such as the top cover door being left open).
- The copier has electronic, mechanical, or interface problems.

To find the problem, you must observe which indicators are lit or flashing in conjunction with the FAULT indicator.

NOTE

To prevent an immediate repeat of the copier's fault condition, perform the required maintenance task before pressing the CLEAR button to clear the fault indication.

Flashing State

A *flashing FAULT* indicator in combination with *flashing READY*, indicator signals the copier is in Service mode.

2.2.2 HOW ERROR CODES ARE PRESENTED

The copier signals an error condition when the FAULT indicator lights steadily. The copier presents the specific error code in three ways on the copier's front panel:

- By using INK LOW, MEDIA, and MAINT indicators to report supply conditions of ink, media, or maintenance fluid.
- By using the PORT indicators to give five possible error conditions for the operator.
- By using a combination of the INK LOW and PORT indicators to provide an extended error code, when the TEST switch is held depressed. The TEST switch only provides this function while the FAULT indicator is lit.

Only one error code is presented unless the operator/technician "asks" for the extended error code (by pressing the TEST button while the FAULT indicator is lit). The copier always presents the first error code encountered in cases where multiple error conditions exist, and the first error condition must be corrected before the next error can be displayed.

A *lit FAULT* indicator, in combination with a *flashing MAINT* indicator, signals that the maintenance liquid cartridge is expended and must be replaced.

A *lit FAULT* indicator, in combination with a *lit MEDIA* indicator, signals that the media supply is empty or media has not loaded properly. You must add new media or check the existing media for problems before continuing the copy operation.

A *lit FAULT* indicator, in combination with a *flashing MEDIA* indicator, signals that media has not loaded or unloaded properly. The operator must clear the media path before continuing the copy operation.

A *lit FAULT* indicator, in combination with a *flashing INK LOW* indicator, signals that the indicated ink cartridge needs replacing.

A *lit FAULT* indicator in combination with a *lit PORT* indicator signals one of five operator error codes.

2.2.3 OPERATOR ERROR CODES

The five operator error codes are presented in a simple format, using the four PORT indicators on the copier's front panel. To display an operator error code, the FAULT indicator must be lit — refer to Figure 2-1. Each lit PORT indicator represents a different copier problem (for example, a lit PORT-1 indicator with a lit FAULT tells you that the copier's top cover door is open). Table 2-5, later in this section, identifies the operator error codes.

- If PORT-1 lights, the copier's top cover door is open.
- If PORT-2 lights, the ink-jet head carriage was not in the proper power-down position over the maintenance station capping position.
- If PORT-3 lights, the ac line voltage to the copier is too low. Turn off the copier or press the CLEAR button and see if voltage has returned to normal. When you turn off the copier, make sure the head carriage assembly is positioned over the maintenance station capping position.

- If PORT-4 lights, the copier has either an electronic, mechanical, or interface fault. At this point, pressing the TEST button displays the extended error code which provides a more definitive fault message. The extended error codes are displayed using the PORT and INK LOW indicators. Tables 2-6, 2-7, and 2-8 in this section and Appendix J *Error Codes* contain a complete list of these error codes and their meaning.

- If all four port lights are lit, then interface protocol has not been observed. A host attempted to "write" to the copier while the copier was "busy." Pressing CLEAR should remove this fault.

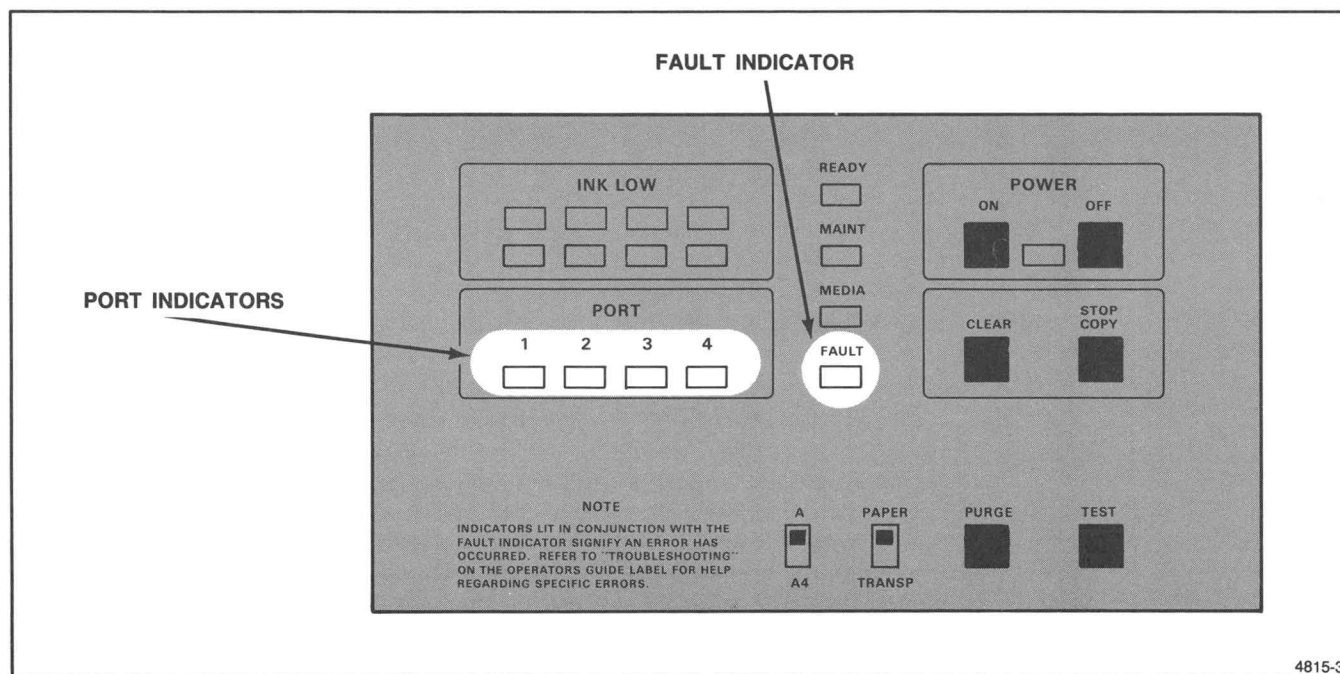


Figure 2-1. Reading the Operator Error Codes.

2.2.4 EXTENDED ERROR CODES

The copier presents extended error codes in a hexadecimal format using the four INK LOW indicators and the four PORT indicators on the copier's front panel — refer to Figure 2-2. Up to 256 different errors can be represented using the eight indicators. Presently, the copier displays 42 error codes. The PORT-4 indicator represents the least significant digit of the error code while the BLACK INK LOW indicator represents the most significant digit of the error code. For example, if all PORT indicators are lit with the Cyan INK LOW indicator, the hexadecimal error code is 8F. Table 2-6, 2-7, and 2-8 identify the extended error codes and their meanings.

2.3 OVERVIEW OF COPIER MODES

The copier can operate in three different modes: Normal mode, Test mode, and Service mode.

2.3.1 NORMAL MODE

This is the mode of operation the copier automatically runs following the initial power-up process. The copier operates in Normal mode whenever it is idle or produces a host requested copy. Normal mode is indicated when the POWER and READY lights are lit. During a copy process, the READY indicator will extinguish and one of the PORT indicators will light up.

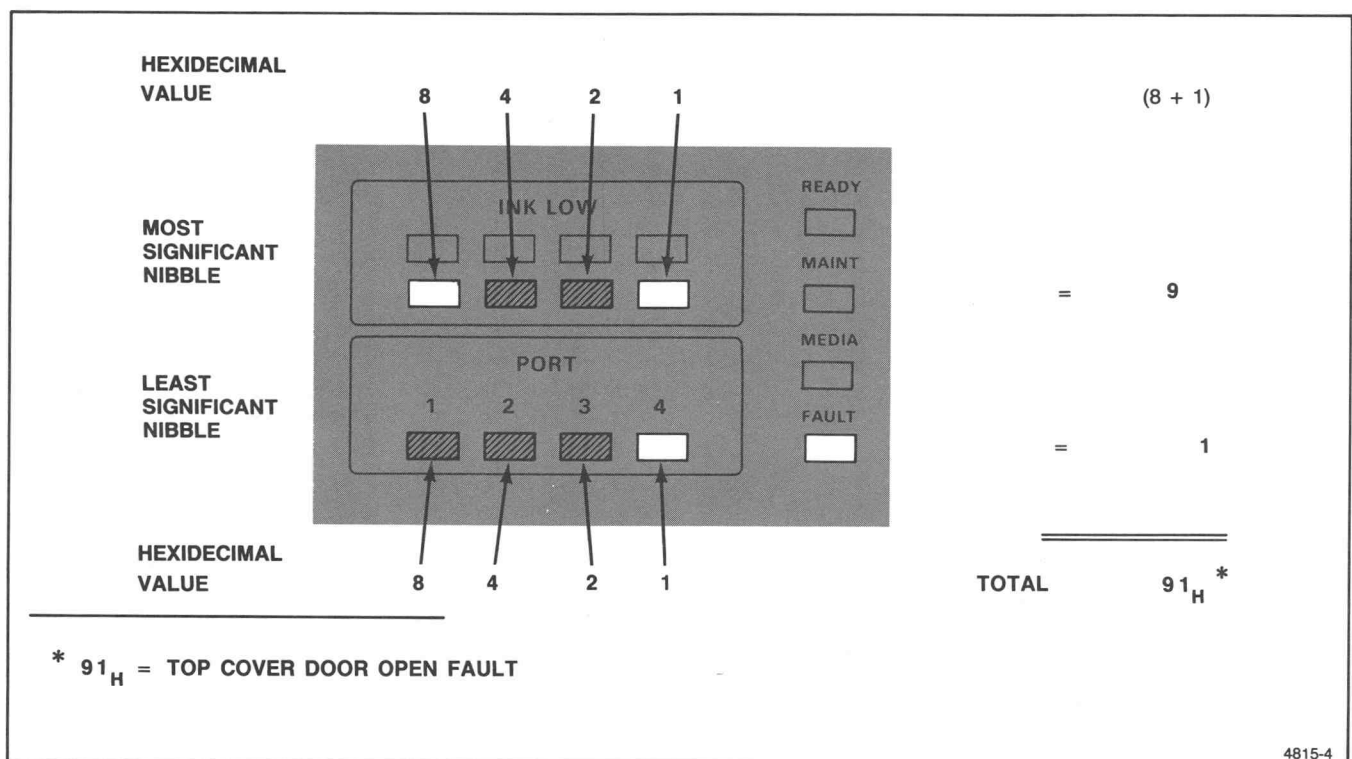


Figure 2-2. Reading the Extended Error Codes.

2.3.2 TEST MODE

The copier enters Test mode from Normal mode whenever the TEST switch is pressed. This mode allows the user to select the four test patterns generated by the copier. The test selected is displayed using the four PORT indicators. These test patterns are used for verifying the ink-jet system performance by checking image resolution, solid fill capability (7 colors), convergence, and image placement. Appendix K *Copier Test Patterns* includes samples of the test patterns. When the copier finishes printing the test copy, the copier automatically returns to Normal mode.

2.3.3 SERVICE MODE

Service mode provides four tests that allow the service technician to exercise, observe, and adjust (if necessary) the operation of the copier's major electro-mechanical systems. The procedures for using these service test are provided later in this section. The Service mode tests are:

- **Test 1 (Air Routine):** Energizes the vacuum and regulated air supply system, which provides pressurized air to the ink-jet heads and the ink cartridges. When this test is selected, you may check and adjust the regulated air system. Pressing the PURGE switch, while in this test, alternately shuts off and turns on the air flow to the ink-jet heads.
- **Test 2 (Wash Routine):** Activates the vacuum and regulated air supply system, moves the head carriage to the head wash position, and waits for you to start the wash pump by pressing the PURGE switch. The wash pump operates as long as you depress the PURGE switch.
- **Test 3 (Media Loading Routine):** Initiates a media load cycle that exercises the media loading system. The media loading systems include the vacuum/air system, the media loading solenoid (fluffer), the drum motor and the drum indexing. Once a sheet of media loads onto the drum, the drum motor is disabled, but the vacuum/blower remains active. This allows you to check the media load position for proper adjustment. Pressing the PURGE switch unloads the presently loaded media sheet and initiates another media load cycle.
- **Test 4 (Ink-jet Head Voltage Adjustment):** Position the ink-jet heads over the maintenance station wash position and activates the ink-jet head amplifiers. The amplifiers are energized, allowing you to adjust the head drive voltage. This test automatically terminates after one minute.

Pressing the STOP COPY switch terminates the test in progress and leaves the copier in Service mode. Then pressing CLEAR returns the copier to Normal mode.

2.4 PROBLEM IDENTIFICATION

Copier problems are grouped into five general categories:

1. **COPIER WON'T POWER-UP.** The copier will not respond to front panel operation. The suspected problem relates to a power supply overload or failure, loss of ac power, or open line fuse. This procedure identifies a sequential method for isolating and testing each of the major components in the copier. Section 2.4.2 "Copier Won't Power-up" details these procedures.
 2. **OPERATOR FAULTS.** These include low or out conditions of consumables (media, ink, or wash fluid). An operator can rectify and clear these fault conditions. These operator procedures are detailed in the *4692 Color Graphics Copier Operators Manual*. Table 2-5 list these errors.
 3. **SELF-TEST FAULT.** When the copier is powered-up, the firmware executes a series of self-tests. These tests check ROM addressing and content correctness, RAM addressing and functionality, and the processor data path including support chips such as PROMs and FPLAs. Table 2-7 identifies the meaning of these error codes and the probable source of the error.
 4. **PROCESS OR INTERFACE FAULT.** When an internal test pattern or copy process is interrupted due to hardware or communications problem, the copier generates a fault indication. Table 2-8 identifies the meaning of these fault codes and the probable source of the error.
- Problems with mechanical functions such as paper loading, carriage indexing, loss of vacuum, or drum indexing are in this category as well as firmware and interface faults.
5. **PRINTING QUALITY PROBLEMS.** This group identifies imaging problems relating to ink-jet head performance and ink delivery system. You identify these problems by examining the imaging quality of the TEST copies. Section 2.5 "Verifying Copier Performance" details these tests.

2.4.1 TROUBLESHOOTING FLOWCHART

The flowchart in Figure 2-3 shows a pictorial diagram of an expedient troubleshooting sequence. The events that line the left side of the illustration are the normal flow when no problems occur. The information to the right of this column identifies a sequential method for identifying the problem.

Troubleshooting Notes

NOTE 1: Before a normal PURGE operation or an extended PURGE using Service Mode Test 1 (Air Routine) is initiated, remove the Maintenance Liquid Cartridge and check the fluid level in the waste portion of the cartridge. If this section is more than half full, replace the cartridge before purging the heads or performing the maintenance procedures. The information in Section 4.3.1 describes the recommended procedure for replacing the cartridge.

WARNING

The Air Pump input line is connected to the waste side of the Maintenance Liquid Cartridge. To avoid pulling waste fluid into the air pump, check the fluid level in the cartridge before proceeding with ink-jet head troubleshooting, maintenance or calibration.

Remove the Maintenance Liquid Cartridge and check the waste liquid level if you use Service Mode Test #1 (Air Routine) or Service Mode Test #4 (Ink-jet Head Calibration).

NOTE 2: Any time you encounter printing problems, perform the following checks before servicing or replacing the ink-jet head.

1. Check the air pressure. See Section 5.2.1.
2. Check the bubble trap on the ink-jet head. See the procedures in Section 4.4.2 for ink delivery system and ink-jet head purging procedures.
3. Check the maintenance station function and maintenance fluid flow. Heed the information in Note 1.

If these systems function properly, refer to:






1. Section 6.3.1 for Ink-jet Head Removal/Replacement procedures,
2. Section 5.3.3 for Head Voltage Adjustment, and
3. Section 5.4 for Imaging Checks and Convergence Adjustment procedures.

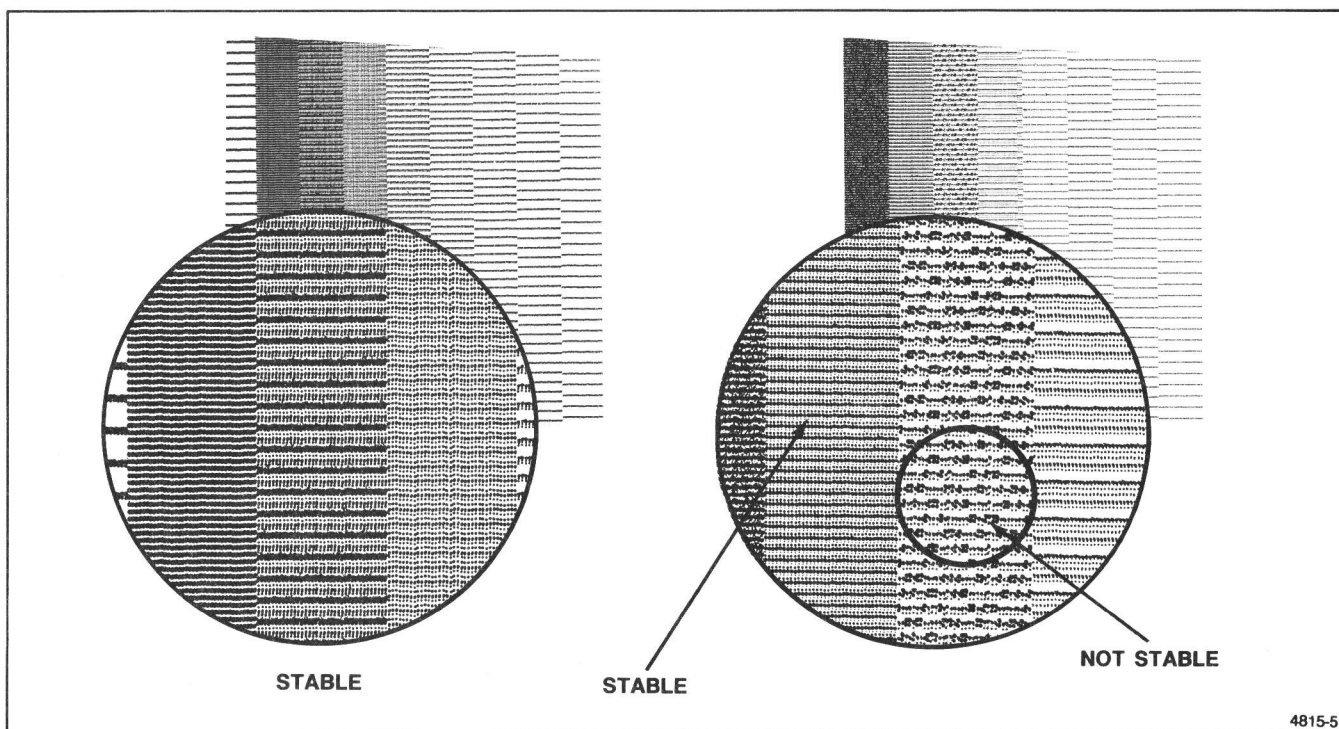
NOTE 3: This test pattern is the most demanding of the ink-jet operation and will usually show anomalous behavior in some of the columns. A shift in printing behavior from column startup (at the bottom of the page) to printing behavior in the middle of the page is normal. The printing behavior should be stable by page midpoint. No more than two columns of any given color's pattern may exhibit instability.

Instability is defined as variations of greater than 50% in the printing performance across the width of a given column at the page midpoint. Refer to the illustration in the table below. It is normal for one column to give indications of instability. Differences in line width or drop shape in the different columns, and from color to color is normal.

Use the Threshold Voltage Pattern Generator (067-1204-00) when identifying ink-jet printing problems and profiling a replacement head.

Table
READING THE TEST PATTERNS

Test Pattern	Problem Illustration	Description
Test 1-Stripes	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>LAST STRIPE (TOP OF PAGE)</p> </div> <div style="text-align: center;">  <p>FIRST STRIPE (BOTTOM OF PAGE)</p> </div> </div>	Drum Restriction or bad bearing. If "ripple" appears worse as stripes progress from leading to trailing edge of media. Check/replace faulty drum component.
Test 1-Stripes		Start-up "hook." Left edge of black stripe appears out of place. Drum movement's restricted, and not reaching imaging speed soon enough. Check drum movement.
Test 1-Stripes		Excessive air pressure. Top edge of stripe "splattered." Check/adjust air pressure. See Sections 5.2.1.
Test 2-Solid Fill		Check for even color density and lack of excessive voids.
Test 3-Ink-jet Head Convergence		Check alignment of colors with BLACK (reference) head. Check and adjustment procedures are in Section 5.4.
Test 4-Frequency	see note 3.	Rough check of ink-jet head performance. If it appears to indicate problems, read notes, and use T.V. Pattern Generator if available.



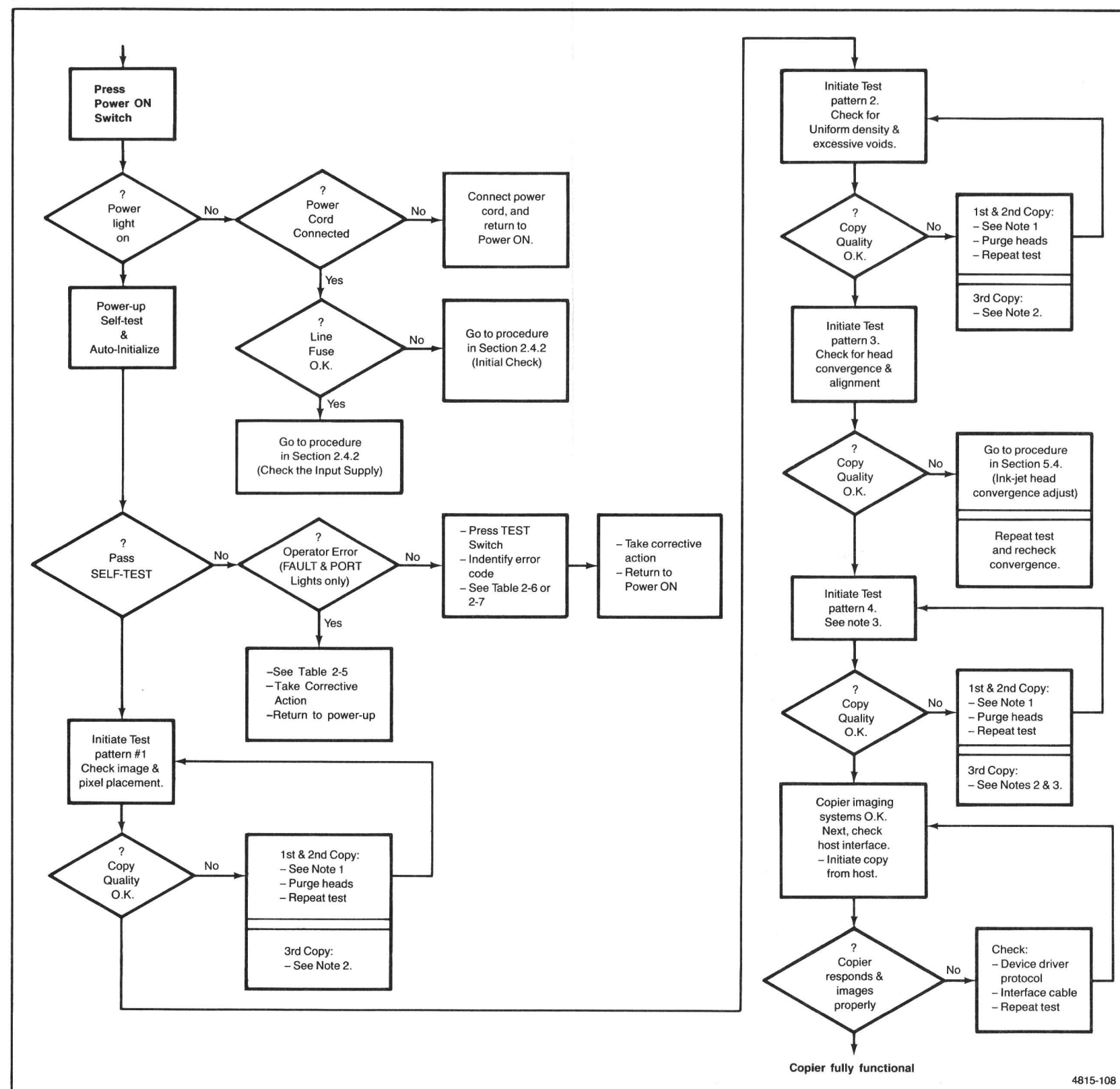


Figure 2-3. Troubleshooting Flowchart.

2.4.2 COPIER WON'T POWER UP

This sequence of steps aid in identifying the power-up problem and in isolating the source. The steps are:

- Initial Check
- Check the Input Supply
- Check the Low Voltage Supplies (Drive Module)
- Initial Electro-Mechanical Components Checks
- Process Control Check
- Exercising the Electro-Mechanical Systems
- Check the Parallel Interface board

Initial Check

These procedures provide an ordered approach to isolating an internal shorting problem of a circuit board or electro-mechanical component. If the POWER lamp fails to light:

1. Ensure the power cord is connected, and the line voltage supplied agrees with the Voltage Selector setting on the rear panel.
2. If these are correct, disconnect the power cord from the rear panel.
3. Remove the Line Voltage Selector/Line Fuse cartridge from the rear panel. The steps in Section 6.4.10 "Power Supply Components" details this procedure. Check the information in Table 2-1 to ensure the fuse is the correct value.

Table 2-1
FUSES

Option	Line Voltage	Fuse
52	100 typical	3.2A SB
STD	120	3.2A SB
A1	220	1.6A SB
A2	240	1.6A SB
A3	240	1.6A SB
A4	240	1.6A SB
A5	220	1.6A SB

CAUTION

If the line fuse is blown, connect the copier's power cord to a 300 watt variable transformer, to check power consumption during slow ramp up of the input voltage, whenever possible. This minimizes potential damage if the copier has an internal short.

4. Disconnect the power cord and replace the blown fuse.
5. Remove the top cover (see Section 6.2.1 "Top Cover" and move to the next procedure titled "Check the Input Supply."
6. Ensure that the front panel cable connectors are secure.

The following progressive isolation of the power supply sections, electronic circuit boards, and electro-mechanical devices will expedite problem identification.

Check The Input Supply

When the power cord is connected, the + 28 volt supply connected to J9 of the Drive Module is active. To check the transformer, rectifier, and filter use the following procedures.

1. Disconnect J9 from the Drive Module. This connector is located on the lower right side of the Drive Module board. See Figure 2-4 if you can't locate the connector.
2. With J9 disconnected from the Drive Module, reconnect the power cord to the rear panel. The + 28 volt supply activates when the power cord is connected.
3. Check for + 28 volts (unregulated) between pins 1, 2 and pins 3, 4 (ground) of P9 on the cable. This voltage should be between + 28 volts (nominal) and + 36 volts (maximum with no load).
4. If the supply is not within limits, troubleshoot the input supply for a faulty component.
5. If the supply is within limits:
 - a. Disconnect the power cord.
 - b. Remove the circuit board assembly. Use the procedures in Section 6.3.1 "Circuit Board Module."
 - c. Use the information in Figure 2-4 to check the fuses on the Drive Module.

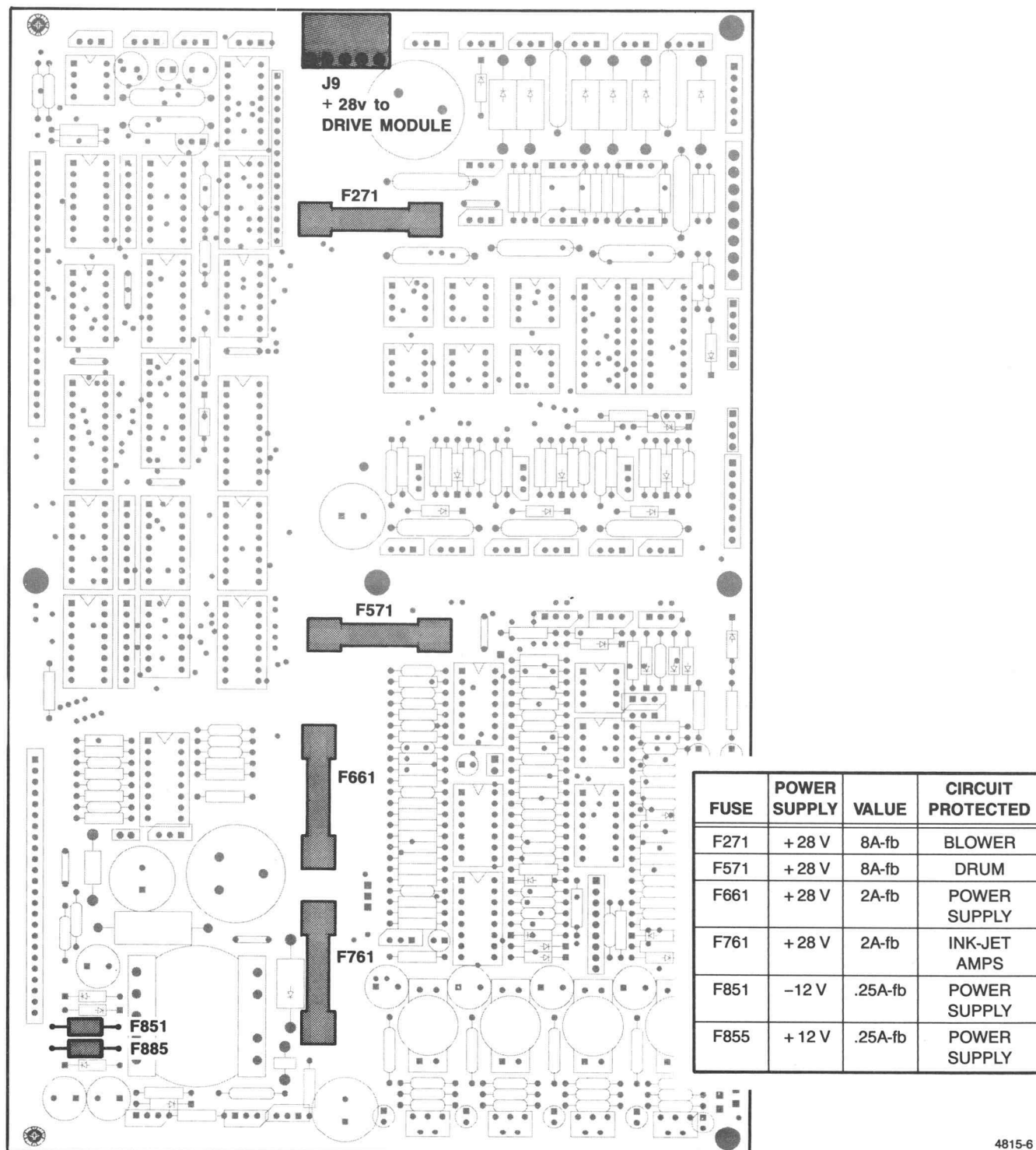


Figure 2-4. Power Supply Fuses on the Drive Module.

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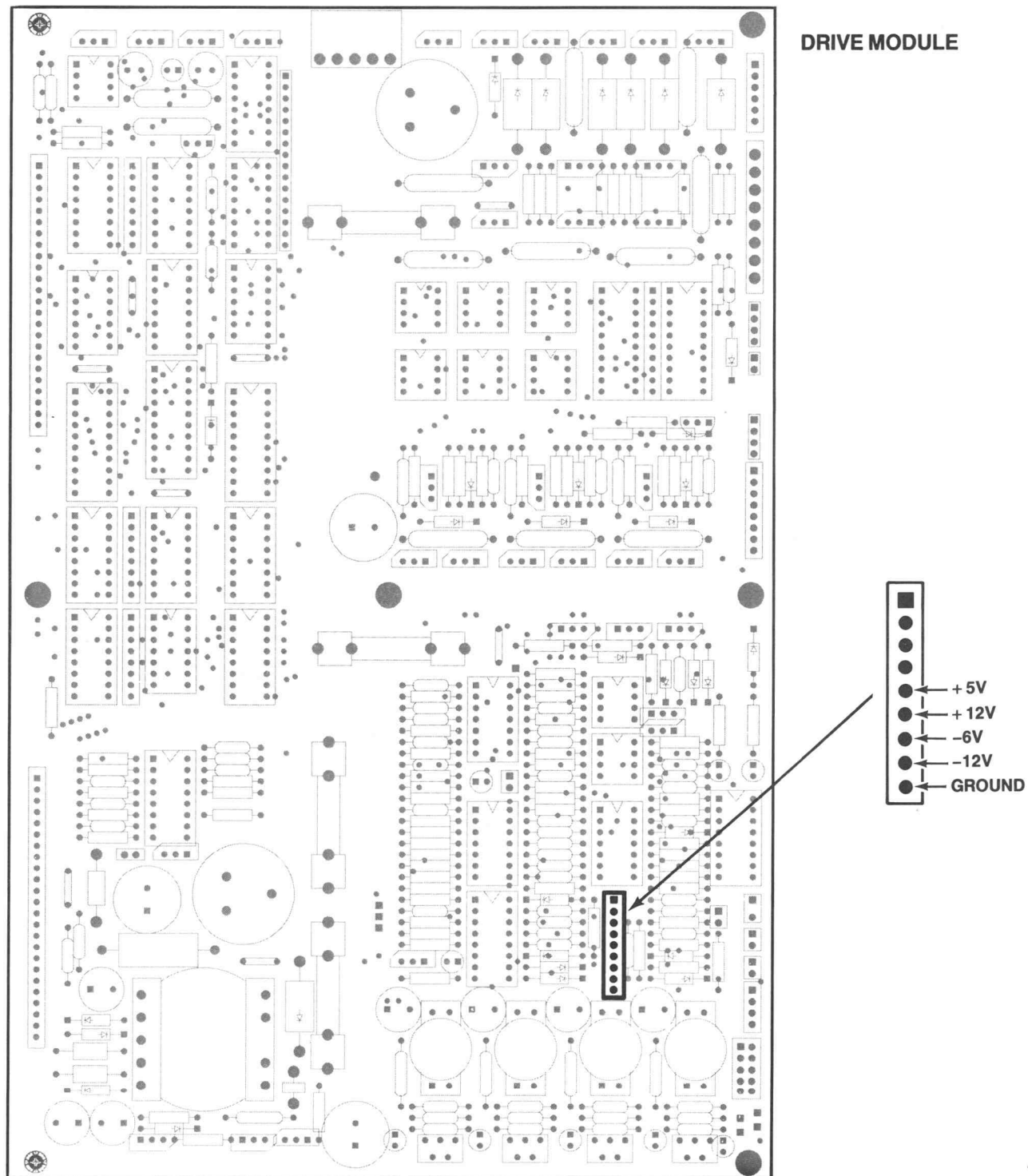


Figure 2-5. Power Supply Test Points on the Drive Module.

Check The Low Voltage Supplies

If the fuses indicate a problem with a low voltage power supply, visually check the circuit boards, wiring, connectors and electro-mechanical components for any indication of a short or failure. While circuit board assembly is removed, disconnect the two ribbon cables (J47 and J49) between the Drive Module and Process Control.

CAUTION

When the cables between the Process Control and the Drive Module are disconnected, place tape over the exposed pins on the male ends of the cables. This prevents inadvertent shorting.

1. Place a jumper across PON (Power On test jumper) on the Drive Module.
2. With J47 and J49 disconnected, return the assembly to the copier, reconnect **ONLY** the J9 connector to the Drive Module, and connect the power cord.
3. Refer to Figure 2-5 and check the dc supplies at J785.
 - a. IF ALL THE SUPPLIES CHECK OUT, you now know that the Process Control, the Parallel Interface or the electro-mechanical components are suspect. Go to the next set of procedures titled "Initial Electro-mechanical Components Check".
 - b. IF ANOTHER FUSE BLOWS, you know that the Drive Module circuit board is the problem. Replace the circuit board. Refer to Figure 2-6 for the correct placement of the cables.

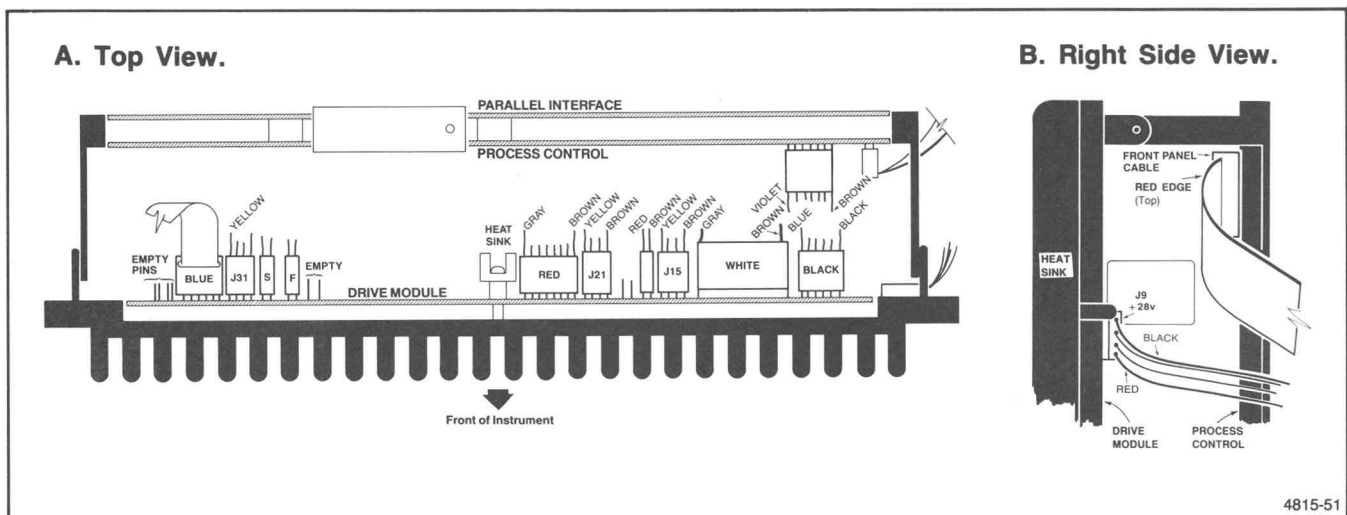


Figure 2-6. Cable Connections to the Drive Module.

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Initial Electro-Mechanical Components Check

If the power supplies are O.K., check the electro-mechanical components connected to the Drive Module using an ohmmeter.

1. Turn the copier power OFF, and disconnect the power cord.
2. Using an ohmmeter, check for the resistance readings shown in Table 2-2. If any of these readings are outside $\pm 20\%$ tolerance specification, the component may be defective.

Table 2-2

**ELECTRO-MECHANICAL COMPONENT
RESISTANCE CHECK**

Connector Number (Drive Module)	Component Name	Resistance (nominal in ohms)
J11 pins 3 + 1	Carriage Motor	30
pins 3 + 2		30
pins 3 + 5		30
pins 3 + 6		30
J13 pins 1 + 2	Blower Motor	.6
pins 1 + 3		.6
J23 pins 1 + 2	Drum Motor	5
pins 1 + 3		5
J25 pins 1 + 2	Copy Counter	300
J27 pins 1 + 2	Fluffer Solenoid	12.5
J29 pins 1 + 2	Strip Solenoid	12.5
J81 pins 1 + 2	Pump Motor	14
J83 pins 9 + 10	Air Solenoid labeled: "3E1"	1150
	"N490"	288

3. Connect the cables (J11, J13, J21, J23, J27, and J29) to the Drive Module. If anything (copy counter for example) was connected to J25, remember to also reattach this cable — see Figure 2-6.
4. Connect the power cord and press the POWER ON switch.
5. If power remains on, you can assume that the electro-mechanical components aren't shorted, but they may still be faulty. You'll need to follow the next procedures before the drum motor, blower, wash pump, fluffer, and solenoids can be exercised.

Check the Process Control Board

This procedure identifies how to isolate the Process Control from the Parallel Interface.

1. Power-down the copier and disconnect the power cord from the rear panel.
2. Remove the circuit board assembly (refer to Section 6.3.1 "Circuit Board Module", and reconnect J47 and J49 (ribbon cables) between the Drive Module and Process Control.

CAUTION

The jumper placed across the PON pins on the Drive Module must be removed. This allows the Process Control microprocessor to exercise the power-up self-test routines.

3. Loosen the two screws at the top corners of the Process Control board, remove the metal clip and the captive connector (J41 to J61) between the two circuit boards — see Figure 2-7. Tighten the two screws after the connector is removed to guard against shorting.
4. Install the circuit board assembly into the copier, connect J9 (+ 28 volt supply) on the Drive Module, and the front panel ribbon connector (J45) on the Process Control.

NOTE

Do not connect cables to the electro-mechanical components at this time.

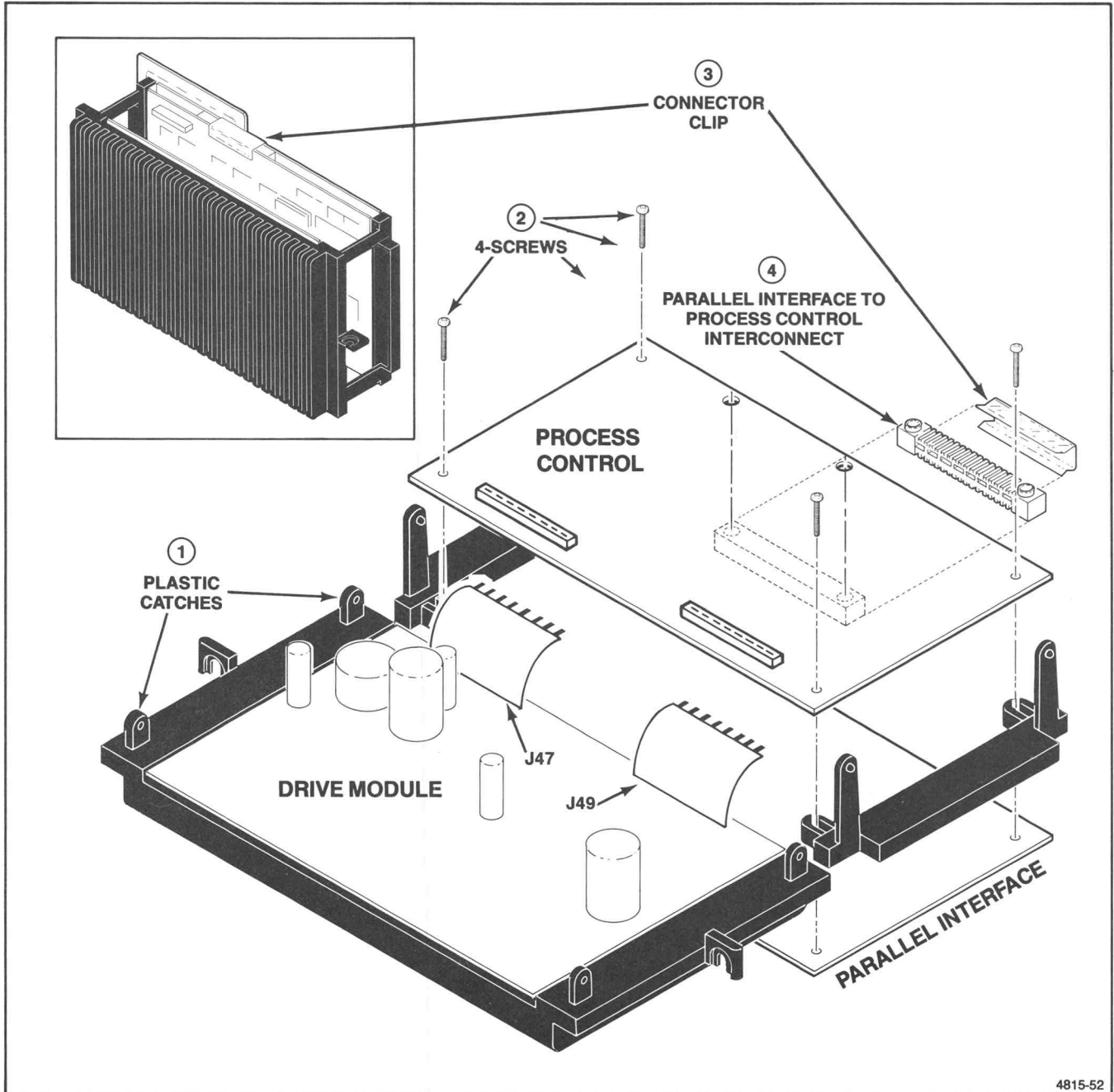


Figure 2-7. Isolating the Process Control and Parallel Interface.

PROBLEM ID AND PERFORMANCE CHECKS

All copier functions, except communication through the Parallel Interface and Test mode pattern 1, 3, and 4, are operable with the captive connector (J41 to J61) removed. We'll complete the electro-mechanical components check after we're sure that the Process Control board is O.K.

CAUTION

The jumper placed across the PON pins on the Drive Module must be removed. This allows the Process Control microprocessor to exercise the power-up self-test routines.

5. Turn the copier power ON. If the power-up self-test exercises the internal routines, the FAULT light will illuminate to indicate an error code. Pressing the TEST switch should display the error code (hexidecimal CB) for a Process Control Protocol Timeout Fault (this error occurs because the Process Control board received no response from the Parallel Interface board with the connector removed). Press the CLEAR switch, and the copier should enter Normal mode.
6. If the copier doesn't respond correctly, identify the choice below, and follow the instructions.
 - a. IF NO FUSE BLOWS, BUT THE COPIER WON'T POWER-UP. Replace the Process Control board. Before replacing the board, you should recheck the front panel cable, low voltage supplies, and front panel board.
 - b. IF NO FUSE BLOWS, THE FRONT PANEL LIGHTS ILLUMINATE, BUT ARE ABNORMAL, press the TEST switch to obtain an extended error code. With the Parallel Interface/Process Control connector removed (J41 to J61) the first error code will be hexidecimal CB. If the copier doesn't respond properly, replace the Process Control board — see Section 6.3.1 "Circuit Board Module."
 - c. IF THE LINE FUSE OR A FUSE ON THE DRIVE MODULE BLOWS, you know that either the Process Control board, J47, J49, or the front panel board is the problem. Identify the cause and replace the faulty part or board. If you replace the Process Control board, follow the procedures in Section 5.4 "Imaging Checks" to ensure proper imaging quality.
 - d. IF EVERYTHING'S O.K., continue with the next procedure to exercise the electro-mechanical components.
7. Power-down the copier.
8. Connect the cables from the electro-mechanical components to the Drive Module.

Exercising The Electro-Mechanical Systems

Service mode provides test routines for exercising the major electro-mechanical systems in the copier.

NOTE

If you followed the previous procedures, attempting to identify a possible short, the Parallel Interface board is still disconnected from the Process Control board.

NOTE

With the Parallel Interface board disconnected, the copier will only execute the Solid Fill test pattern (initiated when TEST is pressed) and the Service mode tests.

When the copier performs the power-up self-test, error code hexadecimal CB is generated due to the captive connector being disconnected. Press CLEAR to remove the fault message and the copier will perform Service and Test routines on command.

Assuming the Front Panel, Drive Module and Process Control circuit boards are O.K., and the electro-mechanical components are not shorted, we'll now exercise these components.

1. The copier should have the power cord connected, and the power ON.
2. To enter Service mode, hold down the STOP COPY switch, then press the TEST switch. The READY and FAULT lights will flash in unison indicating that the copier is in Service mode.
3. To select one of the Service mode routines press the TEST switch. The PORT lights cycle from one through four corresponding to the test numbers in Table 2-4 until the switch is released. A lit port light indicates the test selected. Table 2-4 details the service tests.

Table 2-4

SERVICE MODE TEST ROUTINES

PORT Number	INK LOW Indicator	Function Checked	Pressing PURGE Switch
1	BLACK	AIR ROUTINE – exercises the regulated air system.	<i>Operates air solenoid.</i>
2	none	HEAD WASH ROUTINE activate vacuum system, moves heads to head wash station, and waits for operator to initiate a wash cycle (press PURGE).	Turns on the wash pump. Pump is on for as long as switch is depressed.
3	none	MEDIA LOADING ROUTINE indexes drum & loads media. Then drum stops for media alignment check.	Unloads media on drum and reloads with another sheet.
4	none	INK-JET VOLTAGE ADJUSTMENT ROUTINE energizes ink-jet HEAD driver amplifiers for calibration.	No effect.

^a Shuts off air pressure to the ink-jet heads and applies unregulated pressure (about 80 inches of water) to the ink supply system, and turns the BLACK INK LOW light off. Pressing PURGE again re-applies regulated air pressure to the ink-jet heads and turns on the BLACK INK LOW light.

To terminate a test but remain in Service mode, press the STOP COPY switch.

To exit Service mode press the CLEAR switch.

If Test 1, 2, or 3 do not function properly, perform the related checks and adjustments procedures in Section 5 *Checks and Adjustments*.

Checking the Parallel Interface Board

1. Press POWER OFF, and allow the copier to complete the power-down routine.
2. Replace the captive connector (J41 to J61) between the Parallel Interface and the Process Control.
3. Press POWER ON. If copier won't respond or an error code indicates a problem with the Parallel Interface board, replace the circuit board. Inspect the captive connector to ensure it is not the problem source.

2.4.3 OPERATOR FAULTS

Table 2-5 details the operator error codes.

NOTE

Only one error code will be displayed. This error will be the first error recognized and any printing or test will be aborted.

Table 2-5
OPERATOR ERROR CODES

PORT Indicators				Copier Condition	Assumptions
PORT 1	PORT 2	PORT 3	PORT 4		
off	off	off	off	Operational	No error defined.
ON	off	off	off	Top cover door is open	The operator left the top cover door open.
off	ON	off	off	Carriage was not parked	Head carriage assembly not in cap position at power-up, or at some other unexpected time.
off	off	ON	off	Low ac line voltage	Ac line voltage to the copier is too low.
off	off	off	ON	Copier fault	Either an electronic, mechanical, or an interface fault has occurred. — For more information, perform an extended error code check.
ON	ON	ON	ON	Interface Transition error	A host, presently communicating with the copier, attempted to send data to the copier while the copier had raised the BUSY-1 line to the host.

Table 2-6
EXTENDED ERROR CODES
(OPERATOR RECOVERABLE)

INK LOW Indicators				PORT Indicators				HEX Code Value	Error Condition
BL	CY	MA	YE	1	2	3	4		
Indicator's HEX Value									
8	4	2	1	8	4	2	1		
			X	X				1 8	I/F port busy write-through
X			X				X	9 1	top cover door open fault
X			X			X		9 2	Fluid fault
X			X			X	X	9 3	Media out fault
X			X		X			9 4	Media fault
X			X		X		X	9 5	Media wrap fault
X			X		X	X		9 6	Heads not capped fault
X			X		X	X	X	9 7	Recovery fault

2.4.4 SELF-TEST FAULTS

The copier's extended error codes are presented in a hexadecimal format using the four INK LOW indicators (as the most significant nibble) and the four PORT indicators (as the least significant nibble) on the copier's front panel. Up to 256 different errors can be represented using the eight

indicators. The PORT-4 indicator represents the least significant digit of the error code while the Black INK LOW indicator represents the most significant digit of the error code. For example, if all PORT indicators are lit with the Cyan INK LOW indicator, the hexadecimal error code is 8F. Table 2-7 identifies the extended error codes and their interpretation.

Table 2-7
EXTENDED ERROR CODES
(SELF-TEST FAULTS)

INK LOW Indicators				PORT Indicators				HEX Code Value	Error Condition
BL	CY	MA	YE	1	2	3	4		
Indicator's HEX Value				8	4	2	1		
8	4	2	1	8	4	2	1		
INTERFACE FATAL HARDWARE FAULTS — locks out all operations except Error Code display and power-down functions									
	X	X	X				X	7 1	I/F ROM self-test fault
	X	X	X			X		7 2	I/F RAM self-test fault
	X	X	X		X	X		7 6	I/F buffer self-test fault
	X	X	X		X	X	X	7 7	I/F port self-test fault
	X	X	X	X				7 8	I/F state machine self-test fault
	X	X	X	X			X	7 9	I/F Unexpected interrupt fault
FATAL HARDWARE FAULTS — locks out all operations except Error Code display and power-down functions. These faults represent Process Control problems.									
X	X	X	X				X	F 1	ROM self-test fault
X	X	X	X			X		F 2	RAM self-test fault
X	X	X	X			X	X	F 3	Pattern compensation ROM fault
X	X	X	X		X			F 4	Spatial normalization RAM fault
X	X	X	X		X		X	F 5	Dither ROM test fault

2.4.5 PROCESS/INTERFACE FAULTS

Table 2-8
EXTENDED ERROR CODES
(PROCESS/INTERFACE FAULTS)

INK LOW Indicators				PORT Indicators				HEX Code Value	Error Condition
BL	CY	MA	YE	1	2	3	4		
Indicator's HEX Value									
8	4	2	1	8	4	2	1		
INTERFACE SYSTEM FAULTS — indicative of hardware problems associated with internal processor communications but not fatal to system operation									
	X			X		X		4 A	I/F protocol fault
	X			X		X	X	4 B	I/F protocol timeout fault
	X			X	X		X	4 D	I/F logical record check fault
SYSTEM FAULTS — indicative of hardware problems but not fatal to system operation									
X	X						X	C 1	Vacuum cal fault
X	X					X		C 2	Carriage index fault
X	X					X	X	C 3	Carriage index or vacuum cal fault
X	X				X			C 4	Carriage index or drum index or vacuum cal fault
X	X				X		X	C 5	Drum index or vacuum cal fault
X	X				X	X		C 6	Drum servo fault
X	X				X	X	X	C 7	Drum stop fault
X	X			X			X	C 9	Vacuum adjust fault
X	X			X		X		C A	Protocol fault
X	X			X		X	X	C B	Protocol timeout fault
X	X			X	X			C C	Interface latency fault
X	X			X	X		X	C D	Logical Record check fault
X	X			X	X	X		C E	Maximum line count fault
X	X			X	X	X	X	C F	Unexpected process fault
X	X	X	X	X			X	F 9	unexpected interrupt fault
X	X	X	X	X		X		F A	Received NULL TOKEN fault
X	X	X	X	X		X	X	F B	Transmitted NULL TOKEN fault

2.5 VERIFYING COPIER PERFORMANCE

The previous procedures provided a method for identifying and correcting possible copier failures. The following information details two methods for checking the operation of the copier as a complete unit.

First, the TEST mode allows the copier to produce four different test patterns that check copier imaging parameters.

Second, when you are satisfied that the copier is functioning properly and within specs, the Parallel Interface board and interface protocol from the driving host can be verified.

2.5.1 (TEST MODE) VERIFYING THE INK-JET SYSTEM

The TEST switch is located below the STOP COPY switch on the front panel. Lower the consumables access door for access to this switch. To aid in selecting a test pattern, each PORT light, when illuminated, represents one of the four test patterns. To initiate the desired test, press and hold TEST until the port lamp representing the desired test pattern is lit and then release the switch. Table 2-9 details the test patterns:

Table 2-9
TEST MODE COPIES

TEST Number	PORT Lit	Test Name and Description
1	1	STRIPES— exercises each ink-jet head by printing 10 pixels ON then 10 pixels OFF.
2	2	SOLID FILL— prints solid filled areas to check for consistent color density and area fill.
3	3	CONVERGENCE— shows ink-jet head alignment. The BLACK head is the reference head, and is not adjustable.
4	4	FREQUENCY— shows ink-jet head response to different ink-jet head drive frequencies. Abberations in this pattern indicate possible air bubbles or contaminates in the ink-jet heads.

Copies of these test patterns are found in Appendix K *Copier Test Patterns*.

2.5.2 (SERVICE MODE) VERIFYING ELECTRO-MECHANICAL SYSTEMS

Place the copier into Service mode by first holding down STOP COPY and then pressing the TEST. The READY and FAULT indicators flash together once the copier enters Service mode. Then, by using the TEST button to select Port indicators 1 through 4, different checkout routines can be performed on the copier. Refer to Section 5 *Checks and Adjustments* for the calibration procedures using these tests. The tests are:

TEST 1 (AIR ROUTINE): Energizes the regulated air supply system, providing pressurized air to the ink-jet heads and the ink cartridges. When this test is selected, you may check and adjust the regulated air system. Connect an air pressure gauge to the ink-jet head air manifold before running this test to check for proper pressure and air leaks. See Section 5.2.1, "Air Pressure" for the air pressure adjustment procedure.

This test turns on the air and vacuum system to allow verification of air system performance and to also provide ink pressure for ink-jet head replacement or extended purging. Upon entering this test routine, the blower will slew up to speed, and settle out at the point when the sensor on the vacuum system indicates proper level. Air pressure should also be at the specified level within 10 seconds. Once in this mode, pressing the PURGE button shuts off air flow to the ink-jet heads, and applies unregulated air pressure (about 80 inches of water) to the ink system. This provides constant, positively pressured ink flow for extended purging. During this test, the BLACK INK LOW indicator indicates air flow to the ink-jet heads. It will be illuminated when entering the test. Pressing the PURGE button will alternately turn this light (and correspondingly, the air flow to the ink-jet heads) off and on. BLACK INK LOW indicator off equals ink-jet head air flow off and ink pressure high. Use this test to check for air leaks or varying air pressure.

TEST 2 (WASH ROUTINE): Activates the vacuum system, moves the head carriage to the head-wash position, and waits for you to initiate the wash routine by pressing the PURGE switch. The wash pump operates as long as the PURGE switch is depressed.

When entered, this test turns on the air system and moves the ink-jet heads to the maintenance station wash position. Once in this position, the carriage drive is disabled so that the ink-jet heads may be manually positioned using the drive belt if desired. While in this test, pressing the PURGE button turns on the wash pump for as long as the button is held depressed. If the heads are moved away from the maintenance station to check maintenance liquid flow, a Kimwipe®, or similar lint-free towel should be held above the wash station to absorb the fluid spray.

TEST 3 (MEDIA LOADING ROUTINE): Initiates a media load cycle which energizes the media loading systems. The media loading systems include the vacuum/air system, the media loading solenoid (fluffer), the drum motor and the drum indexing. Once a sheet of media loads onto the drum, the drum motor is disabled, but the vacuum/blower remains active. This allows you to check the media position on the drum for proper placement and alignment. You adjust the media position on the drum by adjusting the fluffer assembly which holds the media input tray. If the fluffer assembly must be adjusted, pressing the PURGE switch will unload the media on the drum and load another sheet. Refer to Section 5.2.4 "Fluffer/Media Position" for the adjustment procedures. Once the proper alignment and placement are acquired, press STOP COPY to exit the current test, but remain in Service mode.

TEST 4 (INK-JET HEAD VOLTAGE ADJUSTMENT): Moves the ink-jet heads to the wash position of the head maintenance station and activates the ink-jet head amplifiers. The amplifiers are energized allowing you to adjust the ink-jet head drive voltage. This test terminates automatically after one minute to avoid inadvertently leaving the test on and wasting excessive amounts of ink. The values you adjust the amplifiers to, during this test, are in turn "compensated" by the Process Control board, during Normal mode operation, to provide the actual values used to drive the ink-jet heads. See Section 5.3.3 "Ink-jet Head Voltage Adjustment."

TERMINATING A TEST: If a specific test routine is in process, exit that routine by pressing the STOP COPY button. The copier stays in Service mode until you either select another test routine, or press CLEAR to return the copier to Normal mode.

To exit Service mode, press the CLEAR button after exiting the test in process. CLEAR will not return you to Normal mode from within a test, but CLEAR (if pressed during a test) will be remembered so once STOP COPY is pressed, the test will stop and then Service mode will be exited.

2.5.3 (NORMAL MODE) VERIFYING COPIER/HOST INTERFACE

For the initial installation of the copier to a non-Tektronix host, you will need to consult the *4692 Color Copier Device Driver Manual* to ensure the proper interface protocol is used. This is only the case if the copier is being connected to a parallel interface that has not previously demonstrated the ability to drive a 4692 copier.

Section 3

THEORY OF OPERATION

INTRODUCTION

This section presents the technical details of producing color images with ink-jet technology. An understanding of ink-jet technology requires:

- A knowledge of color imaging and the fundamentals of additive and subtractive color formation.
- A technical understanding of the data manipulation required to convert an image on a high resolution monitor or pixel data from a computer memory or disc into an image on media. This includes the process that produces 216 different colors from three primary color inks (cyan, magenta, and yellow) and black called dithering.
- The ability to comprehend the workings of the complex electro-mechanical systems required to deliver the ink, load the media, rotate the drum, place the ink on the media, and implement the complex timing of these processes and the image data.

The contents of this section are:

- Background information about additive and subtractive color.
- A general description of how an ink-jet system works.
- A general description of the copier's functions and modes of operation.
- A detailed description of the major circuit blocks, their functions, and the tasks they accomplish in producing the color image.
- A general description of the major mechanical systems.

COLOR FUNDAMENTALS

Whenever someone refers to color imaging, we automatically think in terms of the additive method of producing color pictures. Additive color produces the images on televisions and video display monitors. We perceive the colors we see around us because of subtractive color which is the result of objects reflecting some wavelengths of white light while absorbing others. For example, a green leaf "looks" green because the leaf absorbs both red and blue light and reflects green light to our eyes.

The major difference between these two methods is whether you combine colored light (additive) or remove color from "white light" (subtractive). Since color imaging on media requires reflected light to convey the color hues and saturation, we must produce a color that reflects the desired color information while absorbing all other wavelengths of visible light. Figure 3-1 shows the difference between the two systems.

THEORY OF OPERATION

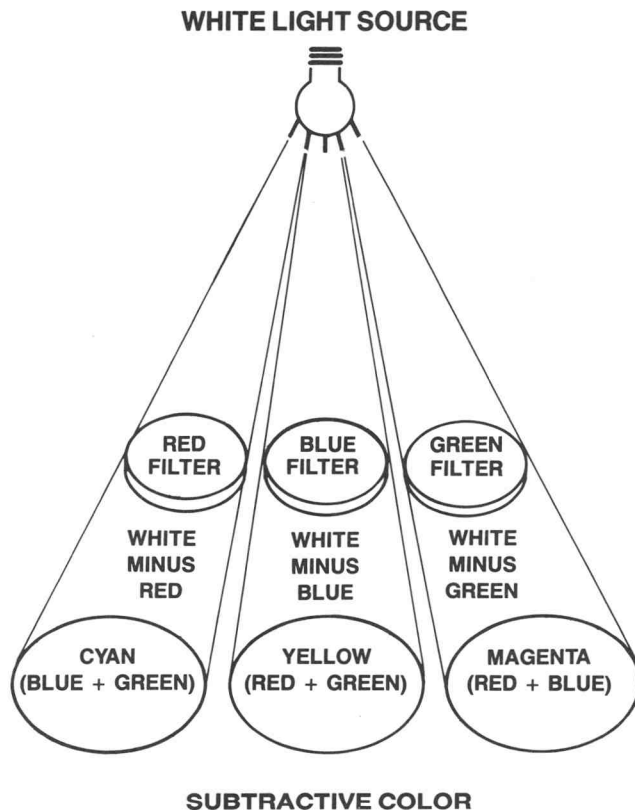
When the copier produces a color, it must determine whether the color is a subtractive primary, additive primary, black, white, or a dithered color. More about dithered color later. The copier produces a total of 216 colors. They are:

- **SUBTRACTIVE PRIMARIES:** These are magenta, cyan and yellow. Since these are the color of the inks in the copier, producing any these colors is as simple as placing a dot of the ink on the media.
- **ADDITIVE PRIMARIES:** These colors are a combination of two of the subtractive primaries. A dot of each of the required subtractive primaries, placed at the same pixel location, produces the additive color.

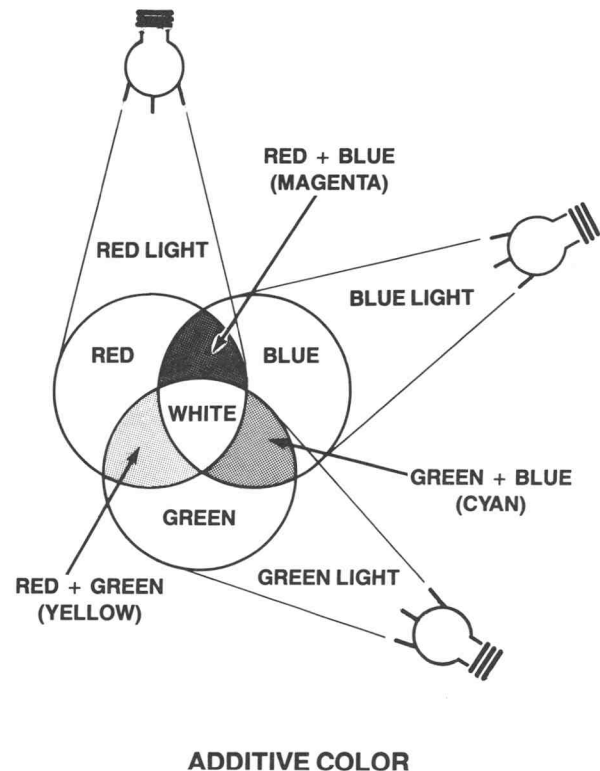
MAGENTA + YELLOW = RED

CYAN + MAGENTA = BLUE

CYAN + YELLOW = GREEN



- **BLACK/WHITE:** Rather than combine all colors to produce black, the copier contains a black ink-jet head and ink supply to produce a true black. Although combining the three primaries inks should theoretically produce black, reality shows that this method of producing black results in a “muddy gray” color.
- **DITHERED COLORS:** This group contains 208 of the 216 possible colors the copier can produce. These colors are produced by displaying a pattern of primary color dots that, when viewed, are visually perceived as a “new” color shade.



4815-10

Figure 3-1. Color Fundamentals.

HOW INK-JET HEADS WORK

Figure 3-2 illustrates the basic principles behind the ink-jet system. The air pump produces air for two purposes. First, air pressure forces ink from the four ink cartridge “bladders” (only one is shown for clarity) to the ink jet heads (only one of these is shown, too). Second, the air pump provides a steady air flow from the nozzle of each ink-jet head. The constant air flow from the nozzle increases the velocity and accuracy of the ink drops. This air flow helps carry the ink droplets to the media.

After the electrical circuitry of the copier processes a print command from the host, the copier stimulates a piezoelectrical crystal in the ink-jet head with a 20kHz signal of approximately 190 volts. When stimulated by the signal, the crystal deflects the flexible wall of the ink chamber (Chamber 1). The deflection and consequent reduced volume in Chamber 1 produces a sharp rise of fluid pressure in the ink chamber. The high pressure forces a droplet out of Chamber 2 of the head toward the printing media. The air flow from Chamber 3 aids in moving the droplets accurately to the printing media.

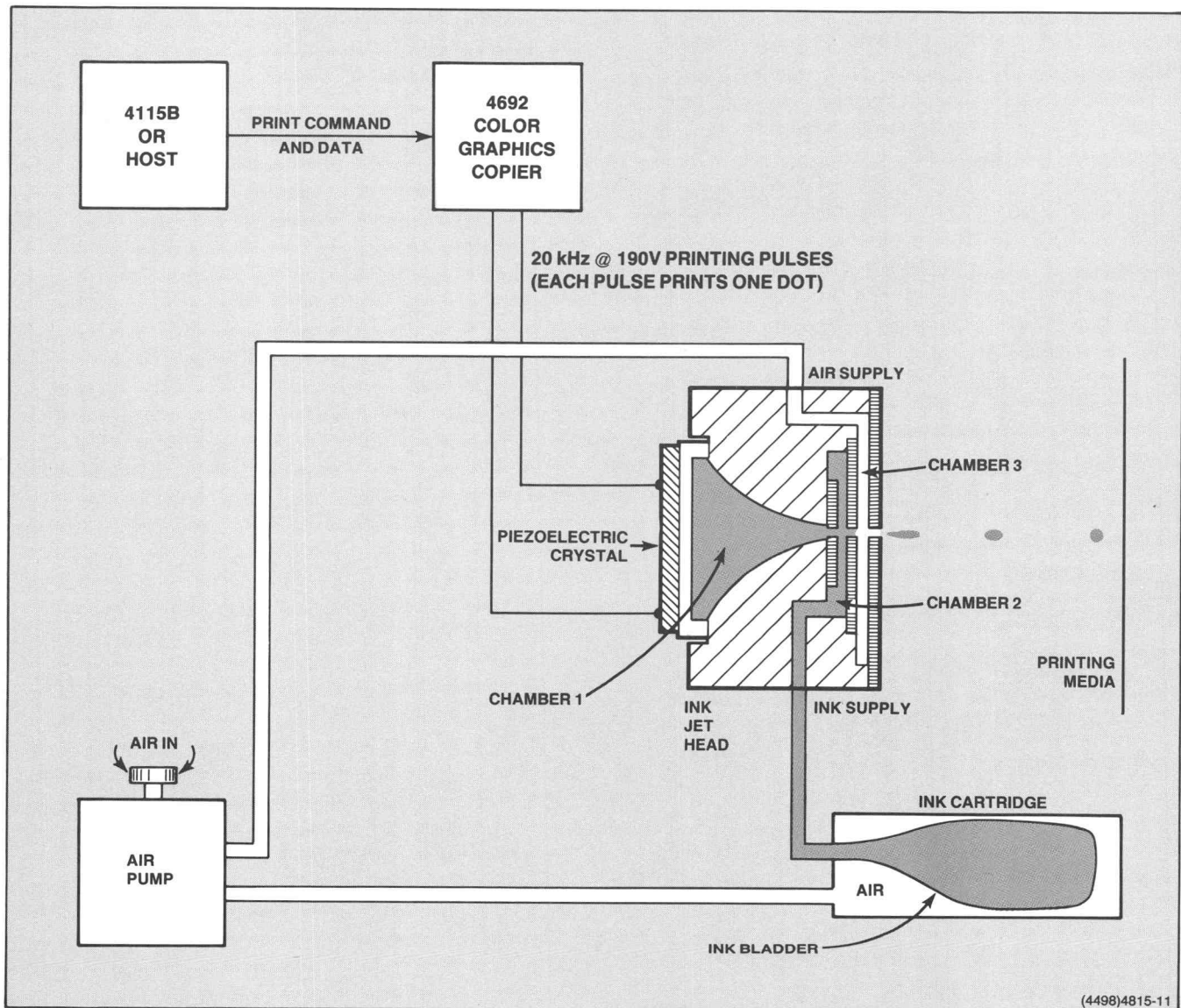


Figure 3-2. Simplified Ink-Jet System.

OVERVIEW OF COPIER OPERATION

The copier must perform a multitude of synchronously timed functions to produce an image on the media. These functions can be grouped into two general areas, image data manipulation and process controls.

The image data manipulation circuitry:

- Establishes a communication link with the host.
- Interprets the image parameters sent by the host which define the image resolution, pixel format requirements, image orientation, and data communication mode.
- Handshakes the image data onto the image data bus.
- Translates the transmitted red, blue, and green (additive primaries) color information into cyan, magenta, and yellow color data (subtractive primaries).
- Dithers the color information, if necessary.
- Convert digital color data into an analog drive signal for the four ink-jet heads.

Once the image data has been translated into the subtractive primaries, the copier must control the processes used to print the information, with color inks, on the media. These processes include:

- Media loading system
- Drum motor drive and control
- Carriage motor drive and control
- Ink-jet head drive and control
- Fluid (inks and maintenance fluid) systems
- Vacuum/air system
- Media unloading when copy is completed

Figure 3-3 shows a block diagram of the copier. It shows a general overview of how the image manipulation circuitry and the electro-mechanical drive systems are constructed.

OVERVIEW OF COPIER FUNCTIONS AND MODES

The following overview presents a non-technical look at the most common functions and modes of operation. These include:

- Turning on the power
- Copier safety interlocks
- Interfacing (by a host computer/terminal)
 - Copy request
 - Copier reserve request
 - Copy abort (operator initiated)
 - Copy Abort (error initiated)
- Self-test
- Turning the power off
- Copier modes:
 - Normal mode
 - Test mode
 - Service mode

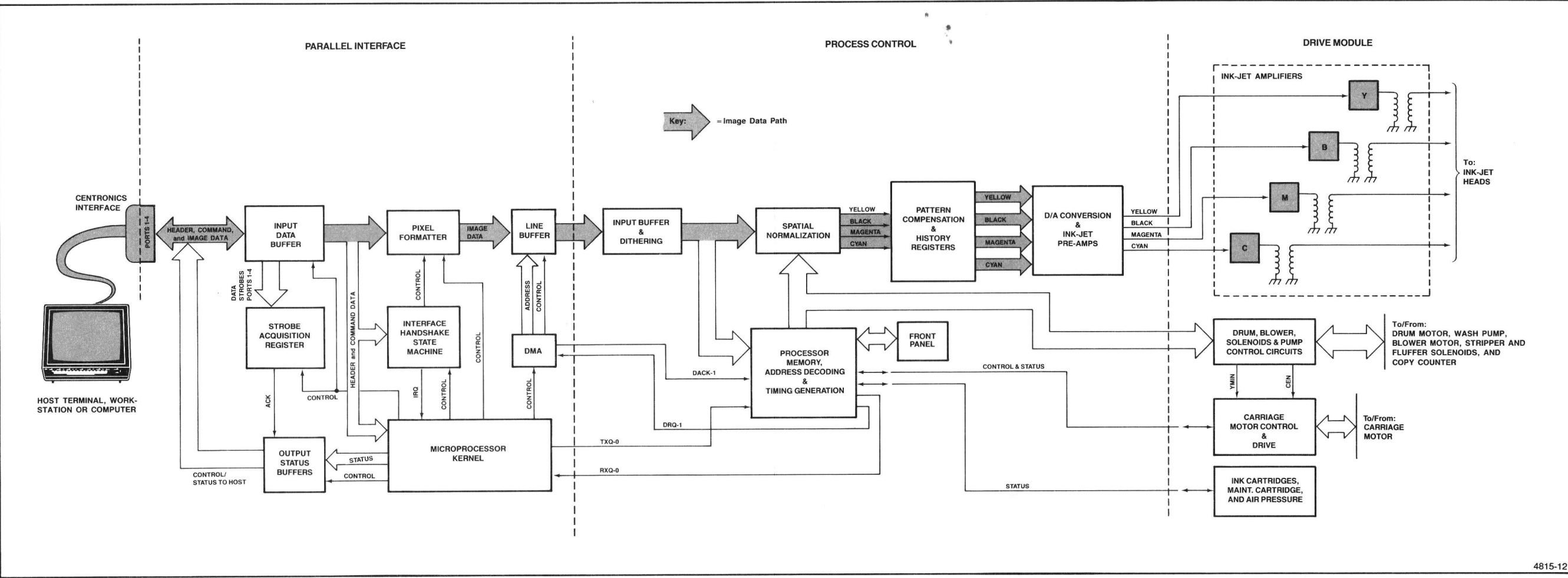


Figure 3-3. Copier Block Diagram.

TURNING ON THE POWER

With ac power connected to the rear panel, the copier is activated by pushing the POWER ON switch. The copier will perform a series of steps before the READY lamp turns on to indicate that the copier is ready for use. These steps include:

- SELF-TEST which checks the following:
 - Interface
 - ROM checksum
 - RAM test
 - Buffer/DMA test
 - Color Map and State Machine
 - Port Data Strobe Latch
 - Preparation for the Print Engine Dither ROM test
 - Print Engine (Process Control/Drive Module)
 - ROM checksum
 - RAM test
 - Pattern Compensation ROM checksum
 - Spatial Normalization RAM test
 - Dither ROM checksum
- INITIALIZATION– moves the ink-jet head carriage from the head-capping position to the head-wash position.
- HEAD WASH– cleans the ink-jet heads to remove any surface contamination and/or dried ink from the head surface.
- HEAD PURGE– flushes the fluid chambers in the ink-jet head to remove any air or contamination.

If no faults are detected during the power-up self-test and initialization, the POWER ON and READY lamps will light. The status of the ink cartridges are indicated by the INK LOW indicators.

If the head carriage is not head-cap position (HOME) when the copier powers-up, the copier correctly positions the head carriage and indicates a FAULT. The copier will be disabled until the CLEAR switch is pressed.

COPIER SAFETY INTERLOCKS

The copier features three interlock switches, four ink cartridges, and a media indicator that are checked by the processors before recognizing any copy request. These checks include:

Ink– All ink reservoirs must have a sufficient quantity of ink. A low ink condition, less than 10%, is indicated on the front panel by a ink indicator (one for each cartridge). If a cartridge is completely empty, its indicator will be on along with the FAULT light.

Media– The media interlock check occurs when the copier loads the media to produce a copy. If media isn't present, or the media tray is out of adjustment and the media fails to load properly, an error is detected and indicated with the front panel MEDIA lamp.

Top cover door– The top cover door must remain closed during operation. If the door is left open before a copy, the copier will not start. If the door is opened during a copy, the drum will slow to minimum velocity, and the copy process will cease. When the cover is closed, the imaging process is terminated and the media is unloaded. Upon completing the unload cycle, the copy request will be unqueued and a FAULT indication will be displayed on the front panel.

HOME Switch– If the head carriage isn't in it's HOME location (head-cap position) a FAULT is indicated. The CLEAR switch corrects this condition provided the head carriage correctly positions on command from the Process Control microprocessor.

Vacuum Switch– The Process Control microprocessor checks a vacuum actuated switch to ensure that the proper vacuum level exists. If the vacuum level is out of spec, an error is generated and the FAULT indicator is lit.

INTERFACING (BY A HOST COMPUTER/TERMINAL)

Once the copier has verified that all systems are operating, it can receive image data from a host computer or terminal. The standard Tektronix Parallel Interface configuration (described in the associated Device Driver manual, requires the driving host to conform to a predefined signal and pinout requirement. The information in Appendix F details the interface connector signal pinout. Refer to the *4692 Device Driver Development Guide* for interfacing specifications and requirements.

COPY; FROM REQUEST TO MEDIA

A host initiates a copy when it transmits a copy request header to the copier over the external interface cable. The copy request header contains information describing the parameters of the copy, such as image resolution, pixel format, and whether the image is to be displayed in either landscape or portrait format. The *4692 Device Driver Development Guide* describes the interface specifications, command instructions, copy parameters, and communication protocol.

Once the initial image and data transmission parameters from the host have been interpreted, the copier proceeds to initialize the media handling and ink delivery systems. Media loads onto the drum, the drum accelerates to imaging velocity, the ink-jets prime for operation, and the head carriage moves over the media to begin imaging.

Data transfers to the copier on a raster line-by-line basis. After each revolution of the drum, the processor checks to ensure the data for the next line is complete and decides whether to print the next line or turn a revolution without printing. In this way the copy process may be interrupted with no adverse effects except extending the copy time.

When the image is complete, the head carriage returns to the head-wash position, the drum velocity reduces to stripping speed (about 30 inches/second), and the stripper activates and removes the media from the drum and places it in the output tray. Upon completing the copy, the copier returns to its initialized state, with all motors off, and awaits the next copy request.

COPIER RESERVE

When a host terminal/computer sends a RESERVE command, it locks out the other ports on the copier until the CLEAR switch is pressed or until the host, which sent the RESERVE command, sends an ABORT command. During this time interval, the host declares "ownership" of the copier and the copier "locks-out" all other hosts from accessing the copier by activating their BUSY-1 lines. The copier indicates a "reserved state" by flashing the port light of the reserving host. Reserving the copier allows a host to make a string of uninterrupted copies or to change the media without interruption. While reserved, the host port may make any number of copies provided that the CLEAR switch is not pressed and that the reserving host does not send an ABORT command to the copier.

COPY ABORT (OPERATOR INITIATED)

The operator may terminate a copy in process by pushing the STOP COPY switch on the front panel. This initiates an unload cycle and unqueues the request at the active port. The copier then returns to an idle state (Normal mode).

If the copier is being operated in Test mode (producing a test pattern), pressing the STOP COPY switch aborts the copy in progress and returns the copier to Normal mode.

In Service mode, the STOP COPY switch terminates the sequence in process and the CLEAR switch returns the copier to Normal mode.

COPY ABORT (ERROR INITIATED)

If the copier detects an error condition during the copy process, it terminates the copy. In this case, the FAULT indicator turns on and the copy request will be removed from the active port. Some fault conditions, a paper jam for example, will place the copier in an inactive state until the operator clears the paper jam and pushes the CLEAR switch.

SELF-TESTS

A confidence test is performed automatically when the copier is powered-up. The operator may also initiate Service mode routines by pushing the correct sequence of switches on the front panel. The Service mode routines allow you to test mechanical functions of the copier that are not tested upon power-up. Test mode is used to select the available internal test patterns. Refer to Section 2 for details of how to select the different Service mode routines and Test mode test patterns.

TURNING THE POWER OFF

The operator initiates a "soft power-down" sequence by pushing the POWER OFF switch. The copier terminates any operation in an orderly fashion, unloading paper if necessary and returning the ink-jets heads to the head-capping position. The POWER ON indicator flashes during the power-down sequence and extinguishes when the sequence is complete. The ac power cord **MUST NOT BE REMOVED** until the power-down sequence is complete.

COPIER MODES

The front panel of the copier provides a direct user interface with the copier. The following information provides the user with a general description of the functional operation of the copier that are visible to the user.

The following explanations include pictorial "state diagrams" to illustrate the sequence of events in each mode of operation, and the inputs that effect a change of state.

The copier has three operating modes: Normal, Test, and Service.

Upon power-up the copier enters Normal mode. While in Normal mode the copier is either in an idle state waiting to produce a copy or producing a copy.

The Test mode is invoked when a request is made from the front panel. While in Test mode, the operator initiates one of four internal test patterns.

The Service mode is initiated from the front panel. This mode allows the operator or technician to exercise the vacuum and air system, purge and wash the ink-jet heads, perform a manual media load to check the media tray alignment, or calibrate the ink-jet head drive voltage.

Normal Mode

Before the ac power cord is connected to the rear panel, the copier is in an ac disconnect state. When the ac power is connected, the copier is in the power-down state. The difference between ac disconnect and power-down is that the 28V unregulated power supply is active in power-down.

Pressing the POWER ON switch begins the power-up sequence. If the head carriage is not at the head-capping position, the FAULT lamp lights, and the copier remains in the fault state until the operator presses the CLEAR switch. The copier will then run the power-up self test routine, and if no errors are detected, the READY lamp will light.

Upon completion of the power-up sequence the operator may:

1. Initiate a PURGE cycle.
2. Initiate a copy from a terminal connected to the parallel interface on the back panel.
3. Initiate a self test from the front panel.

Test Mode

The operator may enter Test mode by pressing the TEST switch. The TEST switch is located below the STOP COPY switch and is accessed by lowering the consumables access door. While in Test mode the operator may initiate four different internally generated test patterns. The four internal test patterns are identified by the PORT lights. Each light denotes a different test pattern.

A test pattern may be terminated at any time by pressing the STOP COPY switch. The copier will terminate the copy sequence, unload the copy in process, and return to the Normal mode with the READY lamp lit.

Appendix K *Copier Test Patterns* shows the four internal test patterns.

Service Mode

The Service mode allows the service person to place the copier in a special state which aids in troubleshooting copier problems. The Service mode is entered from the Normal mode by simultaneously pressing the STOP COPY and TEST switches. While in Service mode, the FAULT and MEDIA, lamps flash together. Refer to Section 2 for more details on Service mode.

ERROR CODE READOUTS

The table in Appendix J *Error Codes* shows the error code readouts and their interpretations.

PARALLEL INTERFACE

INTRODUCTION

Before the Parallel Interface receives data from a source, the copier must have successfully completed the power-up self-test, which verifies the state of the copier and its interfaces. When this series of tests is complete, the copier enters an idle state. A steady READY lamp (not flashing) indicates that the copier is ready to communicate with a host. If the copier failed one or more self-tests, an error code will be displayed, and the problem must be cleared or corrected before proceeding.

GENERAL OVERVIEW

During this explanation, the term "Print Engine" refers to the copier systems which receive input commands and pixel data from the Parallel Interface. In general, the "Print Engine" consists of the Process Control microprocessor, its supporting memory and the controls of the electro-mechanical processes.

The Parallel Interface provides the data path between the host and the "Print Engine." In addition, it determines the protocol as seen by the host. Protocol interpretation and validation is a rather complex and slow task and is handled by the microprocessor. Image data transmission and manipulation may occur at comparatively high rates, and are handled by the Interface Handshake State Machine.

The Parallel Interface performs three generalized functions:

- It communicates with the host to obtain command transactions and image data.
- It manipulates the image data as commanded by the host into a form suitable for the Print Engine.
- It communicates commands and image data to the Print Engine so that the Print Engine generates a recognizable copy.

Two versions of the Parallel Interface exist — a single channel version and a multiplexed four channel version. The single channel Parallel Interface is essentially the same as the multiplexed version, but it has fewer parts and slightly modified logic. Only the four channel version will be described.

To accomplish its tasks, the Parallel Interface contains:

- *Processor Kernel*— which directs the overall operation.
- *Input Data Buffer*— which collects data from the host.
- *Output Status Buffer*— which presents copier status information through the interface ports to the host.
- *Strobe Acquisition Registers*— which identifies that data has entered a port.
- *Pixel Formatter*— which converts the input image data into a form suitable for transfer to the Print Engine.
- *Line Buffers*— which, under DMA control, synchronize the input pixel data with the Print Engine print rate on a raster line-by-line basis.
- *Interface Handshake State Machine*— which handles the pixel transactions. The transaction rate may be greater than the the processor's capability to handle.
- *DMA*— which provides synchronization between the Parallel Interface (input data) and the Print Engine.

To thoroughly understand the operation of the multiplexer, you must understand the proper format for the commands and image data. A complete understanding of the Tektronix *4692 Color Graphics Copier Device Driver Development Guide* is necessary to understand the detailed explanation of the multiplexer.

In general, all communication between the host and the Parallel Interface takes place as command transactions. A transaction begins with a command, such as a COPY REQUEST or a SEND STATUS, and ends when the copy has been completed, the requested status message sent, or a fault causes termination of the transaction.

BLOCK DESCRIPTION

Figure 3-4 is a block diagram of the Parallel Interface board.

Processor Kernel

After the copier's initialized and in Normal mode, the host may send a copy request, copy request header data, and image data. The instructions included in the header define the mode of operation for the Parallel Interface and its Pixel Formatter.

The Interface Processor handles "handshaking" and control signals between the host and copier without interrupting the flow of pixel data. This data handling scheme allows for a fast data transfer rate.

The Interface Processor Kernel performs the following functions:

- Interprets the header information providing the copier with information about image resolution, pixel format, image orientation, and image data transmission mode.
- Uses the information provided in the copy request header to control the flow of image data through the interface.
- Interprets and reacts to control signals from both the input host and the Print Engine for synchronizing the input image data with the Print Engine timing.
- Provides interrupt handling and polling control signals identifying the input port requiring service and which port has priority.

The combination of these functions provides a smooth transfer of commands and image data. The result produces a copy that is a maximum resolution, high quality, color reproduction as requested by the host.

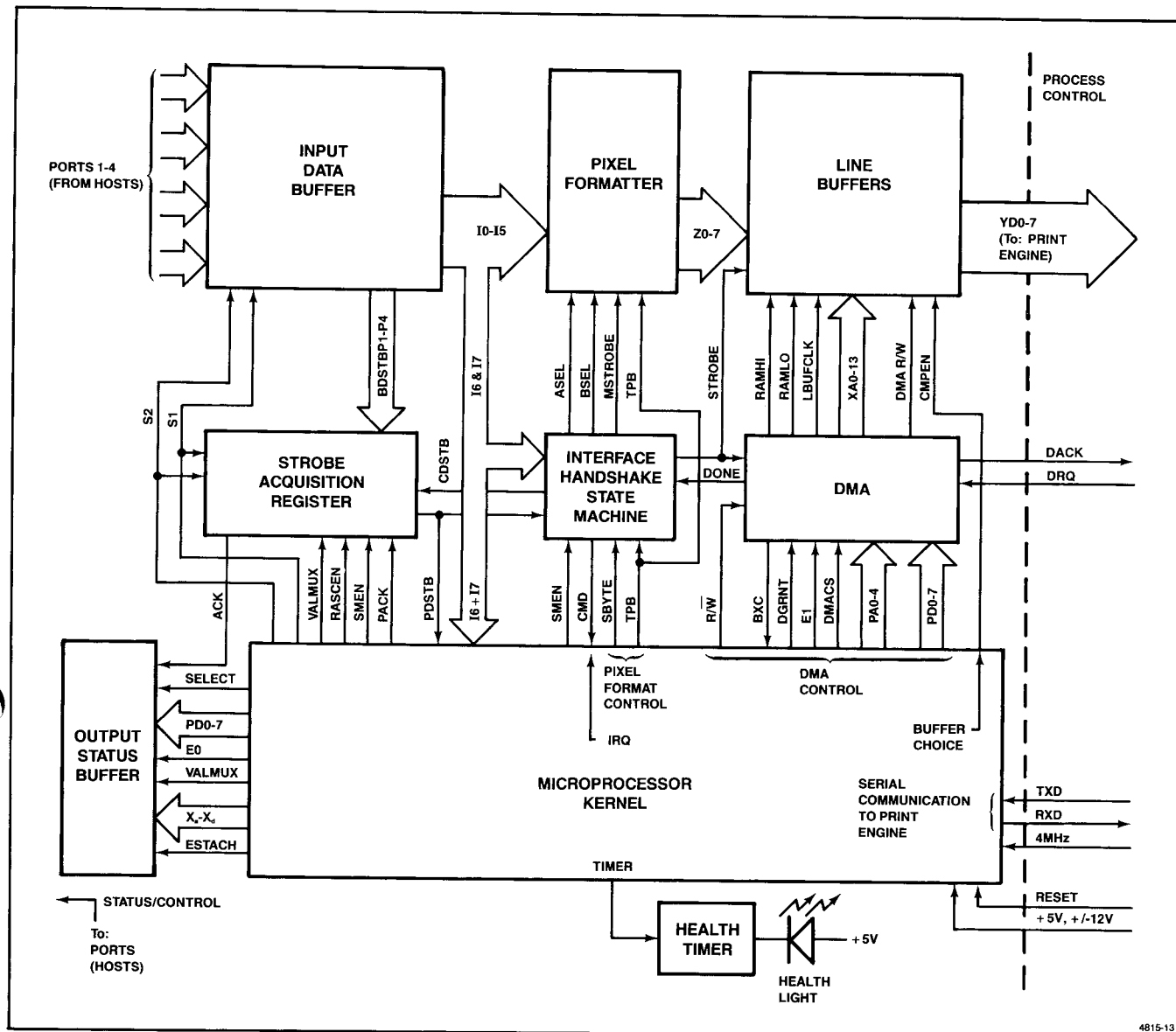


Figure 3-4. Parallel Interface Block Diagram.

Input Data Buffers

The data bits are input through Input Data Buffer, and output to a common bus as the signals I0 to I7. The signals I0 to I5 are the color pixel data and I6 and I7 are communication links (control signals) between the Parallel Interface processor and the host. The data strobes (DSTB-0) from the four ports are buffered by U805 and used to latch the input data into the Input Buffers. The data strobes are then routed to the Strobe Acquisition Registers which record their occurrence.

Output Status Buffers

The Output Status Buffer returns status information to the hosts. Data transmitted from the Processor Kernel to the Output Status Buffers over PD0-7 and Xa-Xd are output directly to the host as BUSY, FAULT, and IR/SO. The ACK line presents the ACKnowledge signal to the port designated by S1 and S2.

After the copier completes the power-up self-test, SELECT-1 indicates to any connected host that the copier is attached and ready for use.

Strobe Acquisition Register

The Strobe Acquisition Register handles the DSTB (Data Strobe) requests from the hosts. These registers latch the requesting DSTBs from the hosts, and present them to U405 which the Processor Kernel polls, looking for a valid command transfer.

Interface Handshake State Machine

The Interface Handshake State Machine controls the flow of pixel data from the interface connectors to the Print Engine, and synchronizes the data with the Print Engine processes. After the Processor Kernel processes the copy request header information, the Interface Handshake State Machine handles the pixel data without intervention by the Interface Processor Kernel until the driving host issues a command. When a command is received, control reverts to the Processor Kernel.

Pixel Formatter

The Pixel Formatter translates the pixel data from the host into an acceptable form for the Print Engine. The Pixel Formatter is capable of formatting the incoming pixels in various configurations. The signals ASEL, BSEL, TPB and MSTROBE control format selection.

Line Buffer

The Line Buffer consists of two "2K x 8" static RAMs configured to provide a "dual line FI-FO" (first in – first out) buffer. As each raster line is received, a FI-FO buffer (under DMA control) is loaded with its contents. While the FI-FO buffer is being loaded with image data, the previously filled FI-FO'S contents are transmitted to the Print Engine also under DMA control. When the current FI-FO buffer is filled, and the previous FI-FO has been emptied to the Print Engine, the address registers in the DMA are alternated. This allows the next raster line of image data to be input to the now empty FI-FO buffer, while the filled FI-FO buffer empties its contents to the Print Engine.

DMA (Direct Memory Access)

The Line Buffers and DMA (Direct Memory Access) synchronize the timing between the host image data received and the Print Engine processes. The DMA, under direction from the Processor Kernel, accepts requests for service from both the Interface Handshake State Machine and the Print Engine, and outputs the necessary addresses and control signals to the Line Buffer.

DETAILED THEORY (CIRCUIT DESCRIPTION)

This discussion begins with the copier receiving a COPY REQUEST command from a host.

Overview

When the copier receives a Copy Request command:

1. The request is latched into the Input Data Buffer.
2. The data strobe is latched into the Strobe Acquisition Register.
3. The Processor Kernel, by sequencing S1 and S2, polls the Strobe Acquisition Registers to identify the requesting port, which is recognized by PDSTB being asserted.
4. Input data in the Input Data Buffer is enabled onto the I0 – I7 data bus and read by the Processor Kernel. The Processor Kernel interprets the data and decides if a valid copy request is present.
5. The Processor sends PACK-1 to the Strobe Acquisition Register which generates ACK-1 to inform the requesting host that the Copy Request command was received.

At this time, the Processor Kernel:

- a. Keeps S1 and S2 static until the command transaction (complete image) is completed.
- b. Locks out all but the selected port by asserting BUSY-1 on those ports.
- c. Continues to poll the selected Status Acquisition Register for DSTBs and collects incoming copy request header data by reading the I0 – I7 data lines until an EOL (end of line) command is received, signifying the end of the COPY REQUEST header.

The Processor Kernel now interprets the header data and sets the appropriate control lines to the Interface Handshake State Machine, Line Buffers, and DMA in preparation for receiving the image pixel data or raster line. The Processor Kernel acknowledges the EOL, and sets BUSY-1 to the requesting port. BUSY-1 remains true until the Print Engine indicates to the Interface Processor Kernel that it is “ready” to receive pixel data.

The Interface Processor Kernel then tells the Print Engine (using the Serial Communication port) that a valid copy request is present. Before the Print Engine indicates it is ready to receive data, it indexes the drum, loads the media, and prepares to receive the pixel data. Once the Interface Processor Kernel receives the reply from the Print Engine Processor, BUSY-1 to the requesting port is dropped, and control is turned over to the Interface Handshake State Machine by asserting SMEN. Image data transmission is now enabled. The Interface Handshake State Machine remains in control until a command byte (signified by its most significant bit –I7- set to a zero) is received.

From now on, any DSTBs received for image data are automatically routed to the Interface Handshake State Machine by PDSTB. The Interface Handshake State Machine routes the received image data (I0 – I5) through the Pixel Formatter and into the Line Buffer. This action is repeated until a command byte (I7 = 0) is received at which time control is returned to the Processor Kernel.

Once a Line Buffer has been filled, the DMA is reconfigured to load to the next Line Buffer, and the DMA now begins to unload the previous raster line to the Print Engine. Each time the Print Engine requires a pixel, it asserts the DRQ (Data ReQuest), and the DMA responds with DACK (Data ACKnowledge) which strobes the next pixel into the Print Engine.

Processor Kernel

The Processor Kernel consists of U351 (a Motorola 6803 microprocessor), U115 (a parallel I/O port), U331 (an 8K × 8 ROM), U335 (address/data demultiplexer), U121 and U125 (parts of each are used for processor address decoding), and U201A (timeout timer — health light driver) — see Figure 3-5. Two additional input ports are provided by U115 (PIA). Port A of U115 (pins 2-9) input the data and commands latched in by the Input Data Buffer. This port can output data to the Input Data Buffer only during self-test. Port B (Pins 10-17) controls the state of various hardware functions. PIA addressing is accomplished by PA0, PA1 and PA5 from the processor and PIACS-0 from U125, the Address Decoder.

The Motorola 6803 operates in Mode 2. This mode determines how the processor functions and is latched during power-up. Rather than explain all of the available options, refer to the 6801-1, 6803 Reference Manual specification from Motorola. Basically, Mode 2 structures the processor for 16 bit addressing with a port (Processor Port 3) multiplexed to provide low order address and data information. Mode 2 includes internal RAM but no ROM.

Mode 2 is determined by CR108, CR109 and R106. The signal RESET-0 forward biases CR108 and CR109 which pulls P20 (pin 8) and P22 (pin 10) low, while R106 pulls P21 (pin 9) high. The condition of these three pins determine the operating mode of the processor. In this case P20 = 0, P21 = 1 and P22 = 0 (010 binary equals 2 decimal).

The 6803 microprocessor used in the interface consists of 128 bytes of RAM and four ports. The port structure is detailed in Table 3-1.

Table 3-1
PROCESSOR CONTROLS

Pin No.	Signal Name	Description
8	SMEN-1	State Machine Enable.
9	TIMER-1	Low to High transition triggers one-shot for "HEALTH" indicator.
10	PCDSTB-1	Clears input data strobe for "handshaking" header data.
11	RXD-1	Serial Communication link from the Print Engine microprocessor.
12	TXD-1	Serial Communication link from the Interface microprocessor.
13	PSTROBE-1	TO: State Machine for DMA execute.
14	S1	TO: Status Acquisition Registers and Input Status Buffers. It is used with S2 for port recognition.
15	S2	TO: Status Acquisition Registers and Input Status Buffers. It is used with S1 for port recognition.
16	PACK-1	Port ACKnowledge. Used for header and command acknowledge to host.
17	Xa (Port 1)	Image relation status bit to host.
18	Xb (Port 2)	Image relation status bit to host.
19	Xc (Port 3)	Image relation status bit to host.
20	Xd (Port 4)	Image relation status bit to host.

U335 is the address decoder for the multiplexed data/address bus. The data and lower eight bits of address are time multiplexed onto the data/address bus as PD0-PD7. The strobe from the processor (called AS- Address Select) is supplied to U335 which stores the lower eight bits of the address and presents this to the address decoders. The data from the processor is only valid during the time "E" clock is in the high state.

All peripherals which output data onto the multiplexed address/data bus must enable data only during the time the "E" clock is in its high state.

One-half of U201A (a one shot) creates the health light. If the processor is capable of executing its code and P21 (pin 9) works, a low to high transition on pin 9 of the processor will trigger U201A and DS460 (HEALTH) will light. The signal (TIMER) is retriggered repeatedly at specific points in the code to keep DS460 lit.

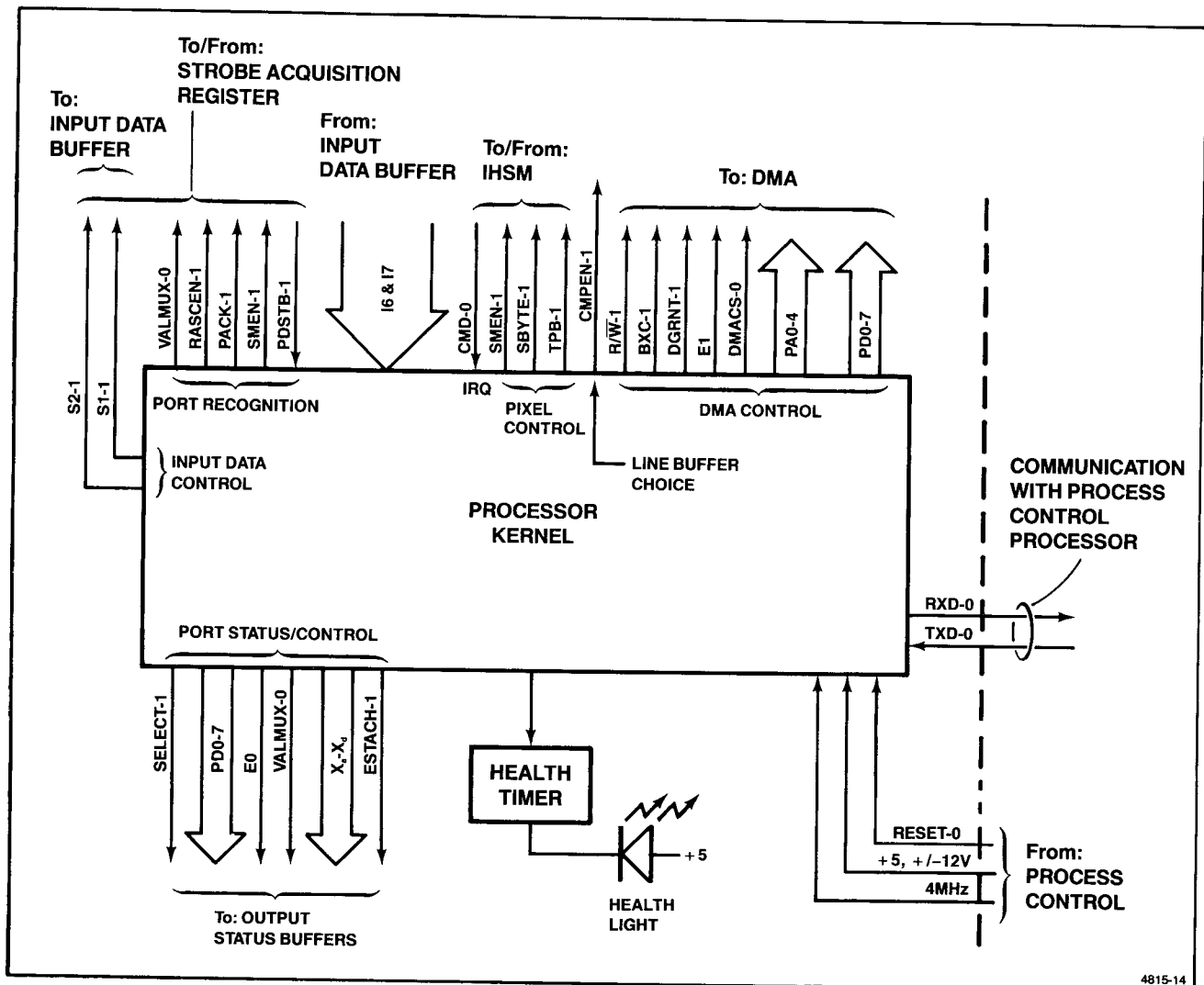


Figure 3-5. Processor Kernel.

THEORY OF OPERATION

Input Data Buffers

The Input Data Buffers consist of the four ports (J63, J65, J67, and J69), four impedance matching networks (R521, R525, R535, and R541), four tri-state data latches (U521, U525, U535, and U541), an address decoder (part of U405), and a strobe buffer (U805). Figure 3-6 shows the inputs and outputs of the Input Data Buffer.

Data presented to any of the ports is strobed into the appropriate latch by $BDSTBP_x$ ($BDSTB$ = Buffered Data Strobe and P_x = requesting port). The $BDSTBs$ are routed to the Strobe Acquisition Registers and the data is multiplexed, using $S1$ and $S2$, onto the data bus as $I0 - I7$.

Impedance matching networks are provided to allow matching for 91 ohm cables.

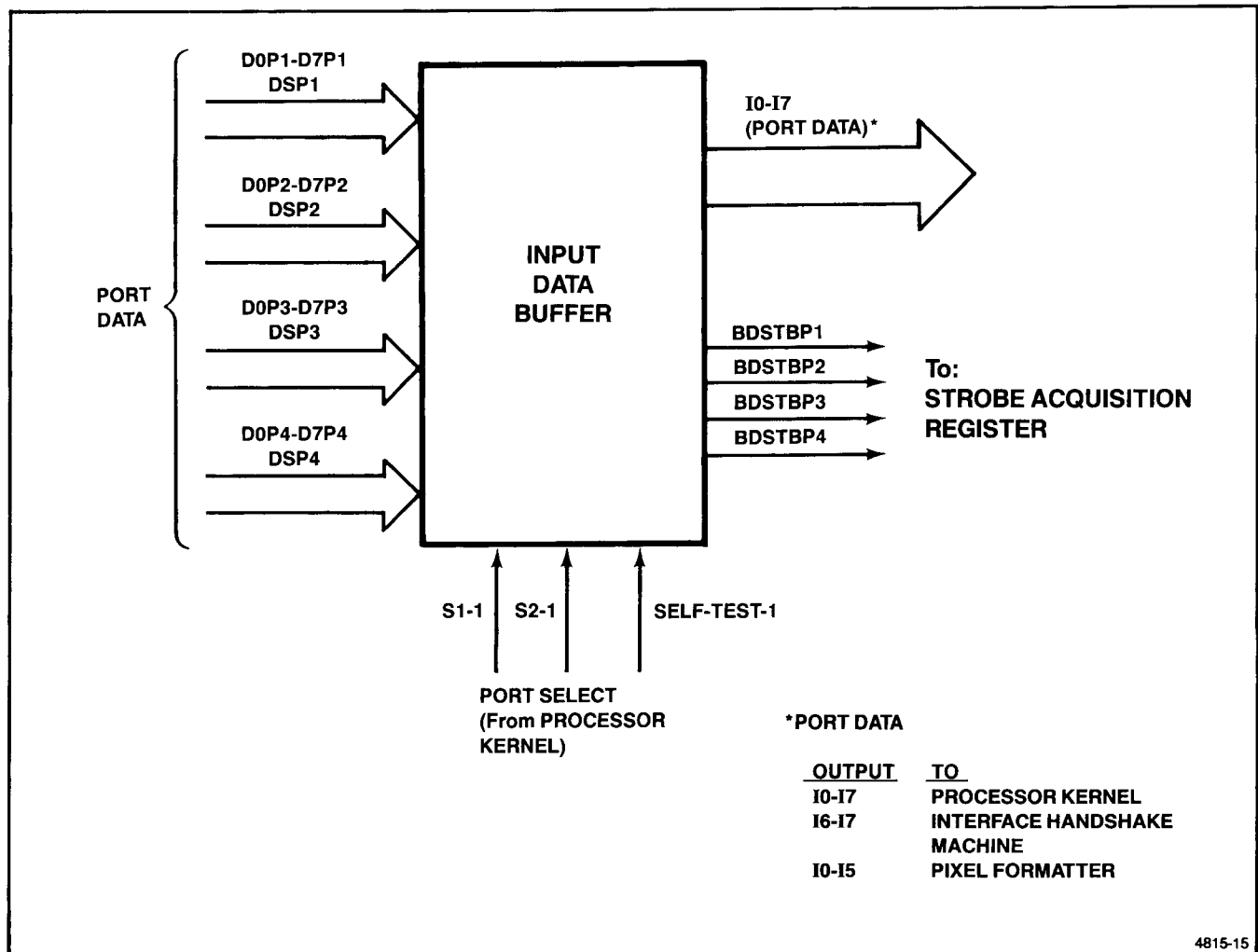


Figure 3-6. Input Data Buffer.

THEORY OF OPERATION

Output Status Buffer

The Output Status Buffer consists of an Enable Decoder (part of U601), a Latch (U411) and two high current line drivers (U511 and U801). A series of impedance matching jumpers allow for cable impedance matching. Figure 3-7 shows the inputs and outputs of the Output Status Buffer.

The Output Status Buffer collects and outputs status information to the various ports. It also provides a signal path during diagnostic self-test.

FAULT and *BUSY* information for each port is generated by the Processor Kernel and latched into U411 with E-0 (the processor clock) when ESTACH (from the address bus decoder) is true. The information is then buffered and sent by the high current driver (U511) to the appropriate ports.

IR/SO information is input from the Processor Kernel as *Xa-Xd* and buffered by U801 before being sent to the proper port.

ACK is sent to U601 where it is validated with VALMUX-0 and demuxed to the correct port as determined by S1 and S2. The resulting ACK-1 signals are buffered by U801 and sent to the proper ports.

The *SELECT-0* signal from the Processor Kernel is supplied to the base of Q101 through R102. The active low signal turns Q101 on which pulls up on the select line to all four ports.

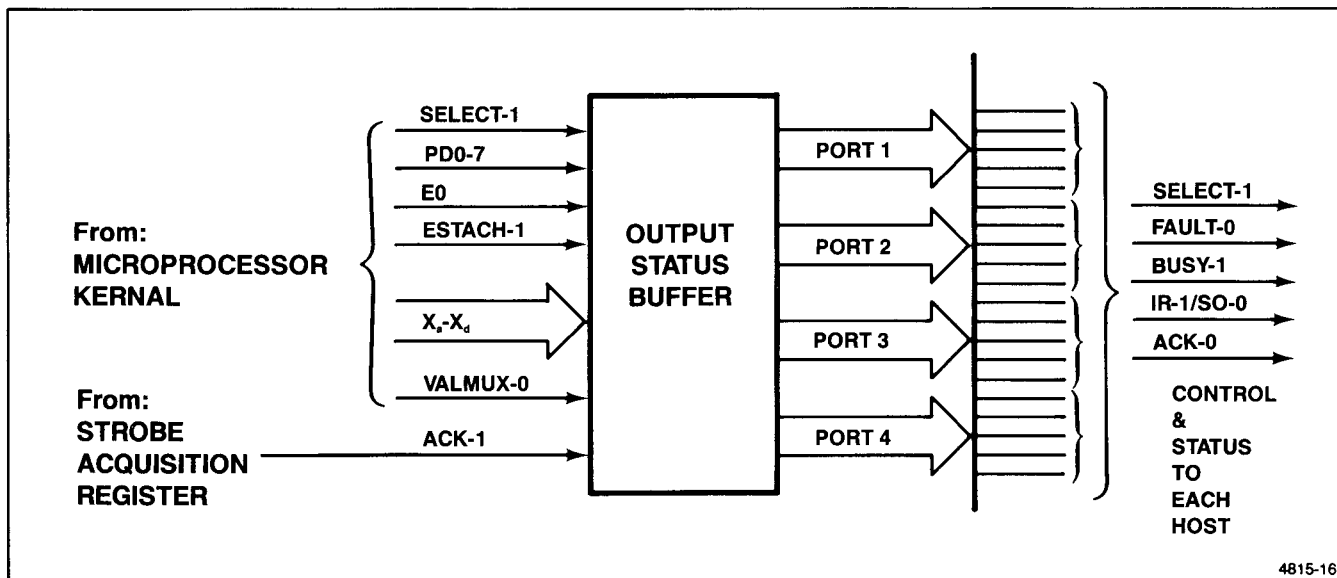


Figure 3-7. Output Status Buffer.

Strobe Acquisition Registers

The Strobe Acquisition Registers consist of four strobe latches, U701A (Port 1), U701B (Port 2), U611B (Port 3), and U611A (Port 4), U405 (Strobe Decoder), U201B (one shot), and part of U601 (Strobe Clear). Figure 3-8 shows the inputs and outputs of the Strobe Acquisition Register.

Initially, the Processor Kernel scans the Strobe Acquisition Registers using the signals S1 and S2 looking for a data strobe at PDSTB. Table 3-2 shows this polling scheme.

Table 3-2
INPUT PORT POLLING

Port Polled	S1	S2	VALMUX
1	0	0	0
2	0	1	0
3	1	0	0
4	1	1	0

The Strobe Acquisition Registers store the occurrence of data strobes from the ports and generate the responding ACKnowledge to the Output Status Buffer. The ACK is either automatic during image data transfer in handshake mode or at processor request when command or copy request header information is received.

Buffered Data Strobes (BDSTBs) are input to the Strobe Acquisition Register where their occurrence is stored. The stored data strobes (QDSTBP1-P4) are then supplied to part of U405 which acts as a multiplexer. The multiplexer, under control of S1 and S2 from the Processor Kernel, routes the appropriate Strobe Register to the PDSTB-0 output of U405 PIN16. PDSTB is sent to the Processor Kernel and the Interface Handshake State Machine for processing. During copy request header acquisition, the Processor is in control and outputs the PACK-1 (Port ACKnowledge) signal to pin 3 instructing U405 to return an ACKnowledge. U405 pin 15 returns the ACK signal to the requesting port through the Output Status Buffers.

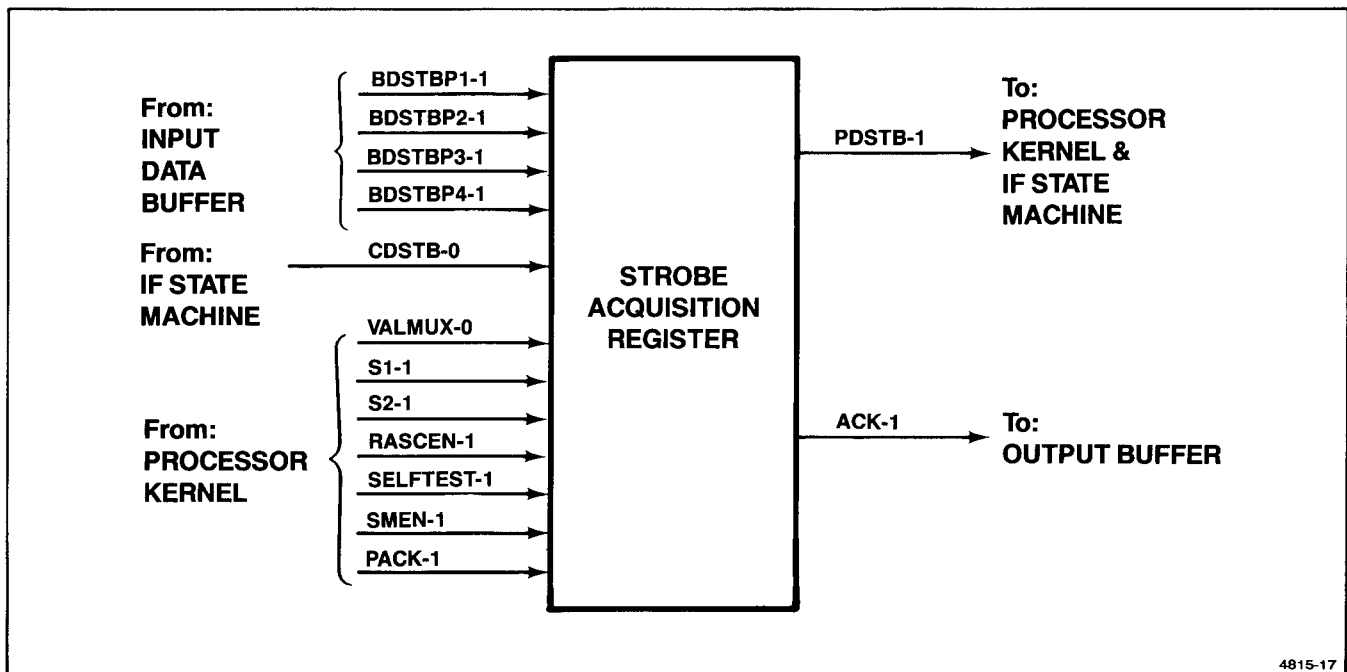


Figure 3-8. Strobe Acquisition Register.

During image data handling in Handshake mode, CDSTB-0 (Clear Data STroBe) is input to U201B from U301 of the Interface Handshake State Machine sets CACK-1 (Centronics ACKnowledge) which is routed to U405 pin 19 and output to the Output Status Register as ACK-1 on pin 15. During Streaming mode, SMEN-1 (Streaming Mode ENable) is enabled, and RASCEN-1 (RASTER CENTronics) is disabled. This causes U405 pin 18 to deassert AAEN-1 (Auto-Acknowledge ENable) which holds U201B disabled, thus preventing generation of CACK-1. Each time CDSTB and VALMUX are asserted together, the Strobe Registers selected by S1 and S2 are cleared to prepare for the next DSTB from the port.

Image data may be transmitted from a host in either Handshake mode (where the copier ACKnowledges receiving each data byte) or in Streaming mode (where the copier only Acknowledges receiving each raster line of data bytes — not the individual data bytes).

Interface Handshake State Machine (IHSM)

The Interface Handshake State Machine (IHSM) consists of U305B and U305D (synchronizing flip-flops), and U301, U305A and U305C (state machine proper). Figure 3-9 shows the inputs and outputs of the Interface Handshake State Machine.

The Interface Handshake State Machine directs pixel flow through the Parallel Interface during image acquisition. It acknowledges receiving pixel data from the host, directs the formatting of pixels, and controls the loading and unloading of pixel data into the Line Buffer. In addition, it informs the Processor Kernel when non-pixel data is received.

The IHSM is under control of the Processor Kernel and is enabled under program control by asserting SMEN-1 (State Machine Enable) on pin 8 of U315.

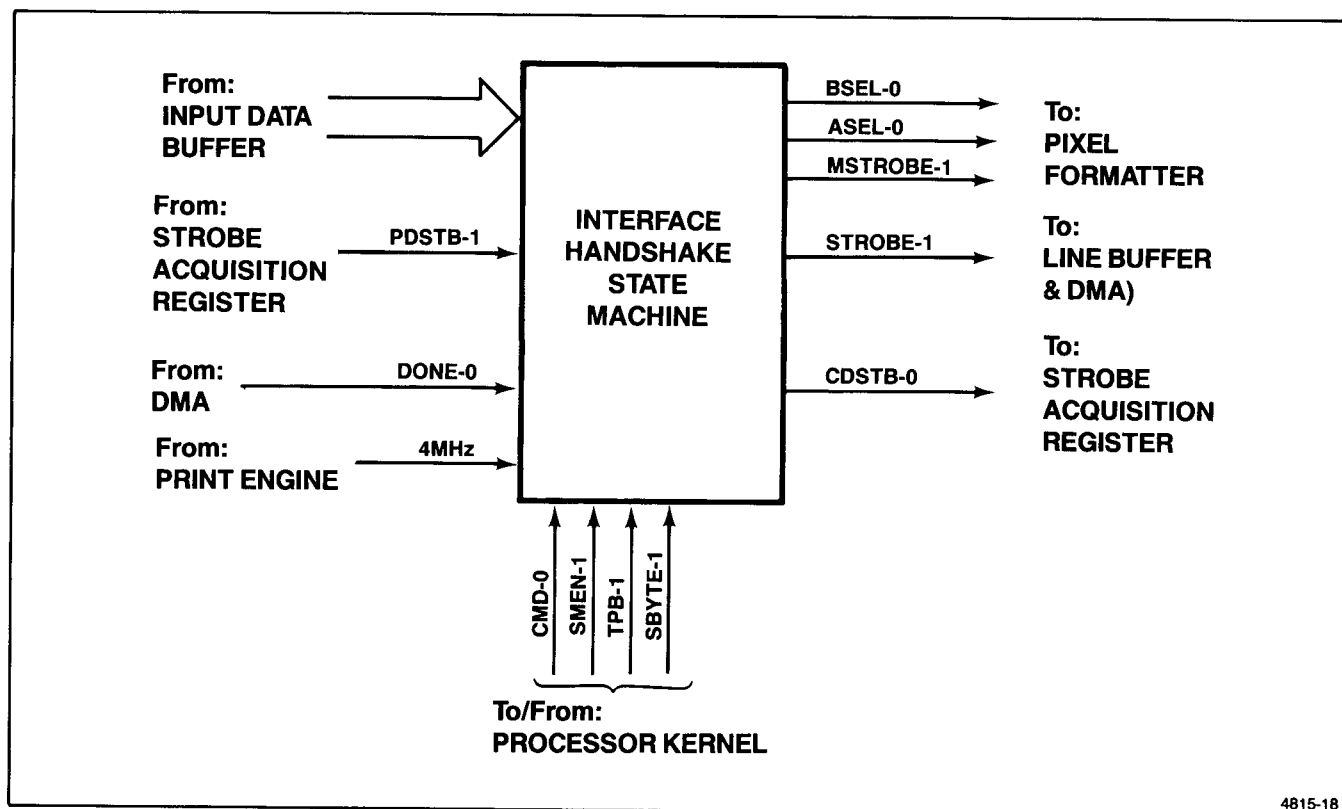


Figure 3-9. Interface Handshake State Machine.

THEORY OF OPERATION

U305B and D are clocked at 4Mhz. These flip/flops are used to synchronize (with the State Machine) the asynchronous external signals PDSTB from the host and DONE from the DMA.

The Interface Handshake State Machine has four possible modes. The Processor Kernel selects the desired mode of operation by the setting of the SBYTE and TPB control lines — see Table 3-3. The copy request header received from the host contains information which determines the transmission (and Pixel Formatter) mode of operation.

Table 3-3
PIXEL TRANSMISSION MODES

Mode	TPB	SBYTE
Two Bytes/Pixel	0	0
One Byte/Pixel	0	1
Two Pixels/Byte	1	0
INVALID	1	1

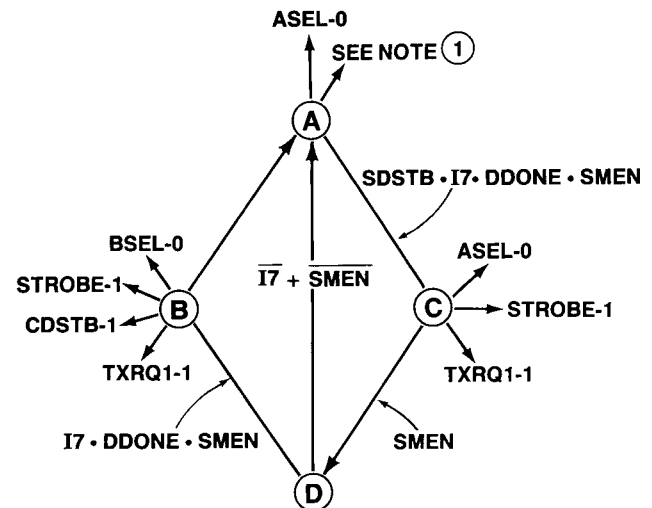
The IHSM operates in four possible states (A through D). State A is always the idle or initial state. When SMEN-1 is false, the State Machine registers are cleared and the State Machine is forced into State A.

Two Pixels/Byte Mode. Figure 3-10 is a state transition diagram for Two Pixel/Byte (TPB) mode. All four states are used in this mode of operation. During State A:

- STROBE is asserted causing PSTROBE to be asserted
- PCSTB is asserted causing CDSTB to be asserted
- ASEL will be asserted

When SDSTB, I7 and DDONE are true, the state machine advances to State C. During State C ASEL-0 is true causing the pixel to be saved in the Line Buffer holding latch (U261). Asserting STROBE-1 at this time initiates a DMA request.

The next transition of the 4Mhz clock forces the IHSM into State D. BSEL-0 is now asserted which causes the transformation of the second pixel. When DONE is received from the DMA indicating that the previous pixel has been stored in the Line Buffer and I7 indicates that data is present, the IHSM will move to State B. In State B CDSTB is issued to the Strobe Acquisition Register to clear the received data strobe. STROBE-1 is asserted to latch the pixel into the Line Buffer, BSEL-0 is true to insure the pixel transformation, and STROBE-1 is asserted to generate a DMA request.



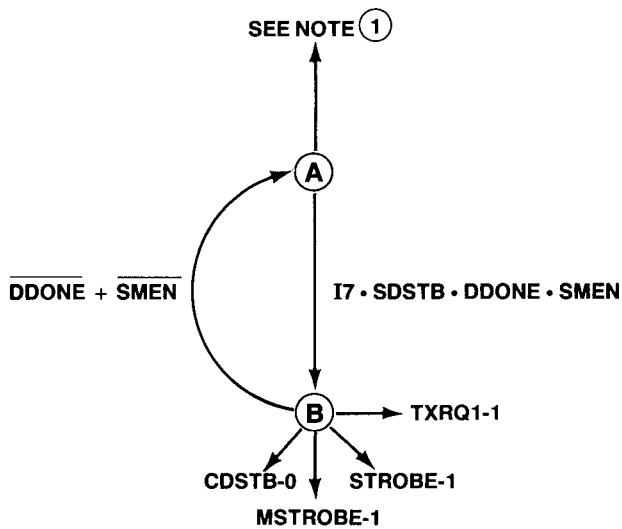
NOTE:

- ① STROBE-1 = PSTROBE-1
CDSTB-0 = PDSTB-1
CMD-0 = STSTB · I7

4815-19

Figure 3-10. Two Pixels/Byte Mode State Diagram.

One Byte/Pixel Mode. Figure 3-11 shows that the IHSM only uses State A and State B in this mode of operation. The state transition requirements from State A to State B and back are the same as described in Two Pixels/Byte mode.



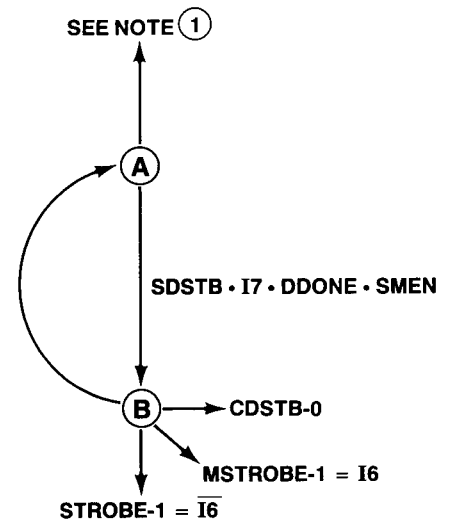
NOTE:

- ① STROBE-1 = PSTROBE-1
CDSTB-0 = PDSTB-1
CMD-0 = STSTB • $\overline{I7}$

4815-20

Figure 3-11. One Byte/Pixel Mode State Diagram.

Two Bytes/Pixel Mode. Figure 3-12 shows that the IHSM only uses State A and State B in this mode of operation. The state transition requirements from State A to State B are the same as described in Two Pixel/Byte mode. The transition back to State A always occurs on the next clock cycle.



NOTE:

- ① STROBE-1 = PSTROBE-1
CDSTB-0 = PDSTB-1
CMD-0 = STSTB • $\overline{I7}$

4815-21

Figure 3-12. Two Bytes/Pixel Mode State Diagram.

THEORY OF OPERATION

Pixel Formatter

The Pixel Formatter consists of U421, U425, U431, U435, and U441 (Formatter proper) and U251 (the Color Map ROM). Figure 3-13 shows the inputs and outputs of the Pixel Formatter.

The Pixel Formatter translates the image data as received from the host into a pixel format which is suitable for the Print Engine. Pixels may be received from the host in various formats. Each of the received formats must be converted into a "standard pixel" before the Print Engine receives it. The Pixel Formatter uses information supplied by the Interface Handshake State Machine and Processor Kernel to determine the pixel boundaries in the incoming data. The pixel information is then collected and used to form an address to the Color Map Prom (U251) which outputs a "standard pixel" — see Figure 3-14.

Depending on the pixel format (as defined by the received copy header information) each pixel may contain either one, two or four bits of color information for each of the color primaries (red-green-blue). The greater the number of bits per primary, the greater the possible color combinations. The gates and latches of the Formatter are enabled to transform the incoming data into a 12 bit address (3 colors × four bits) for presentation to the Color Map PROM (U251) — see Table 3-4. The Color Map PROM translates the incoming R-G-B pixel into the Cyan-Magenta-Yellow (CMY) format needed by the Print Engine, and truncates the selection into eight bits. The eight bit color number is output as Z0 through Z7.

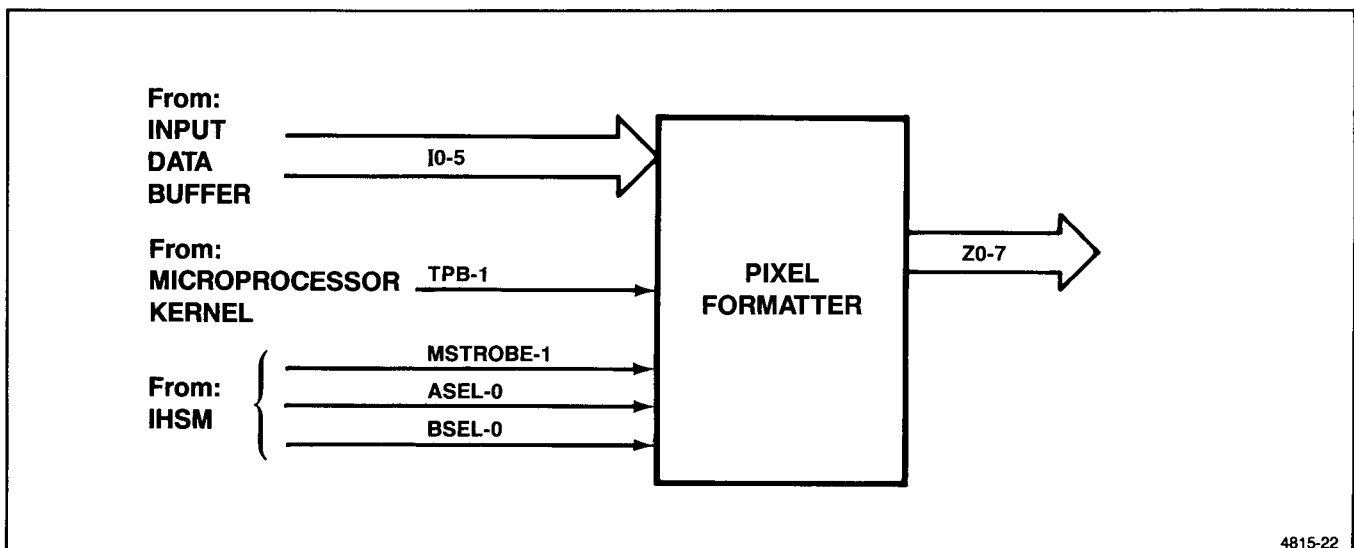
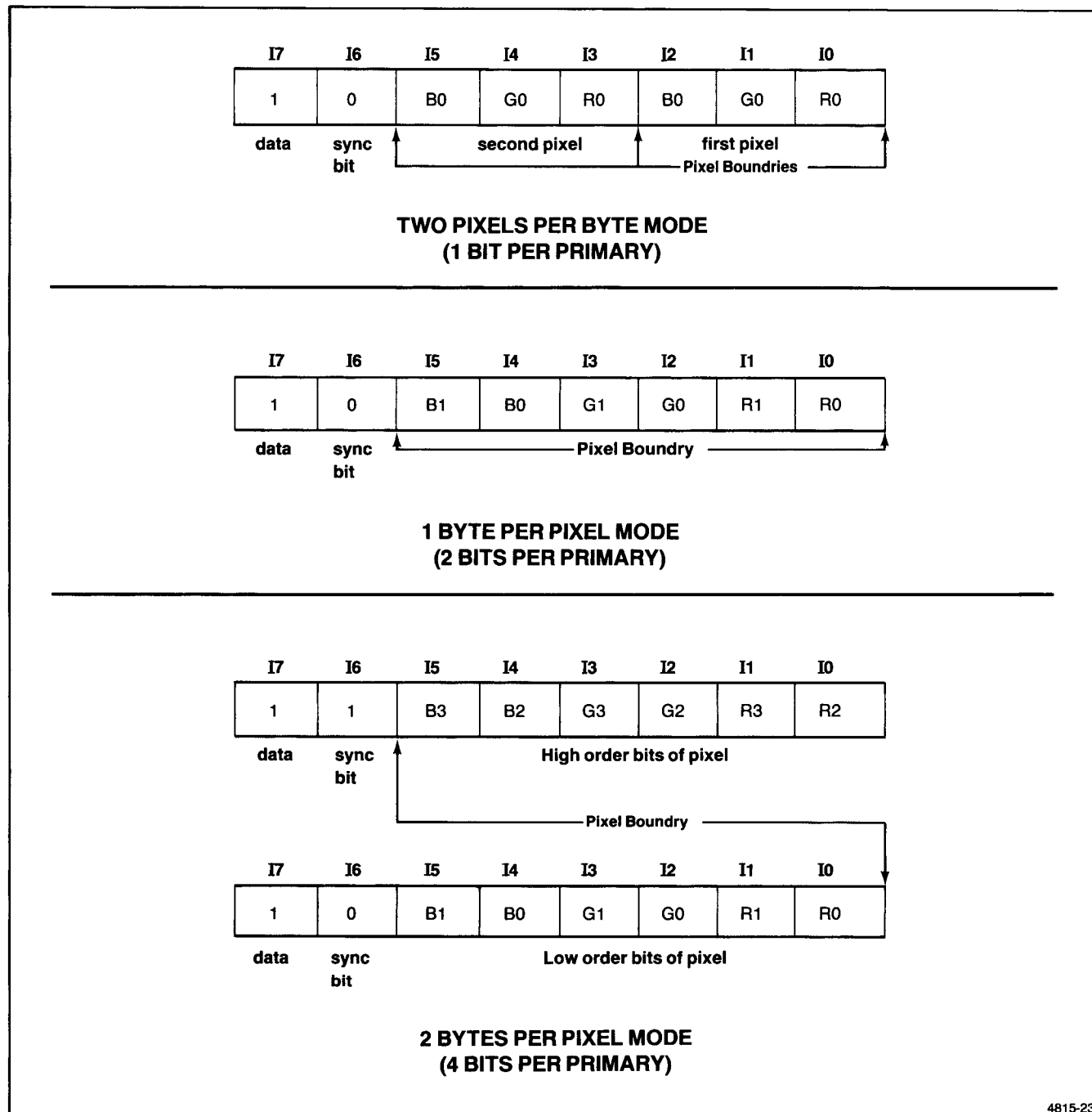


Figure 3-13. Pixel Formatter.

The Pixel Formatter, acting on instructions from the State Machine, configures the CMY pixel data from one of three formats:

- Two Pixel/Byte = 1 bit/primary
- One Byte/Pixel = 2 bits/primary
- Two Bytes/Pixel = 4 bits/primary

Figure 3-14 shows the pixel structure and pixel boundaries for the three formatting modes, and Table 3-4 shows the enabled portions of the Pixel Formatter for each mode.



4815-23

Figure 3-14. Data Structure For The Three Format Modes.

THEORY OF OPERATION

Table 3-4
PIXEL FORMATTER MODES

Mode	Chips Enabled	Description
1 bit/primary	U421, U425, and U431	Defines two pixels with one byte. (2 pixel/byte)
2 bits/primary	U435 & U441	Defines one pixel with one byte. (1 byte/pixel)
4 bits/primary	U435 & U441	Defines one pixel with two bytes. (2 bytes/pixel)

Table 3-5 reflects the format chosen by ASEL and BSEL (from the IHSM) and TPB (from the Processor Kernel).

Table 3-5
PIXEL FORMATTER MODE CONTROL

Formatter Mode	ASEL-0	BSEL-0	TPB
Two Bytes/Pixel	0	0	0
One Byte/Pixel	0	1	0
Two Pixels/Byte	1	0	1

Two Pixels per Byte Mode. In this mode U435 and U441 are disabled (tri-state). U431, U425 and U421 are enabled and their outputs are controlled by ASEL-0 and BSEL-0.

The Pixel Formatter must develop a 12 bit address space for the Color Map ROM. Looking at the data present on I0-I5, we see that two pixels have been received, each consisting of three bits. To accomplish the proper conversion, two conversions must take place in the Pixel Formatter. First, U431 and half of U425 are enabled by ASEL-0 which translates I0, I1 and I2. The translation in the Pixel Formatter results in the following outputs:

first pixel: I0 = R0 = X8, X9, X10, X11
I1 = G0 = X4, X5, X6, X7
I2 = B0 = X0, X1, X2, X3

Figure 3-15 shows this transformation.

The address X0-X11 will cause the color number to be output on the Z0-Z7 bus and the Interface Handshake State Machine causes this pixel to be saved in the Line Buffer.

Next ASEL-0 is deasserted and BSEL-0 is asserted which enabled U421 and the second half of U425 in preparation for translation of the second pixel. The resulting transformation will be:

second pixel: I3 = R0 = X8, X9, X10, X11
I4 = G0 = X4, X5, X6, X7
I5 = B0 = X0, X1, X2, X3

Again, the Interface Handshake State Machine causes the transformed pixel to be saved in the Line Buffer.

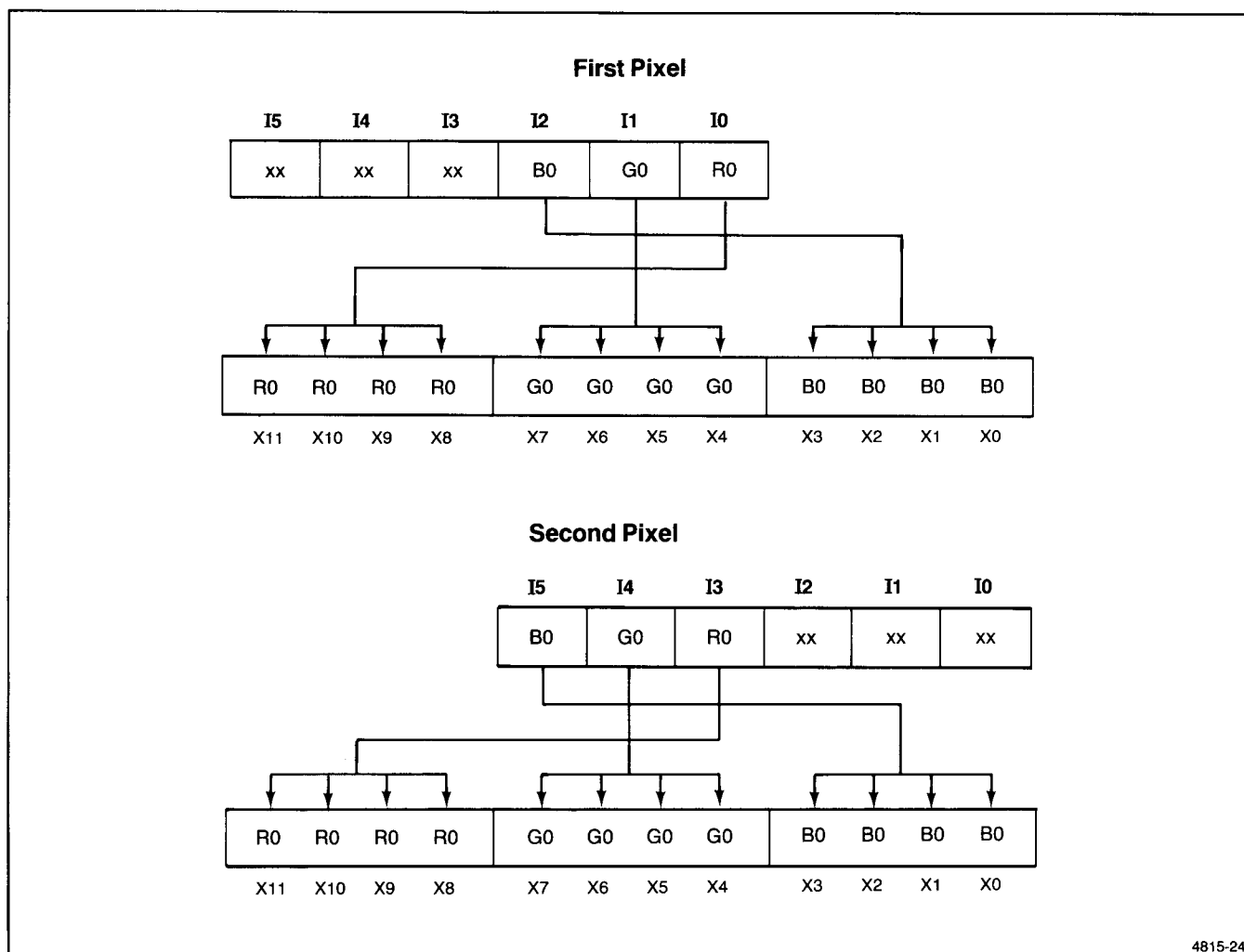


Figure 3-15. Formatter Transformation (2 Pixel/Byte Mode).

THEORY OF OPERATION

One Byte Per Pixel Mode. In this mode U431, U425 and U421 are inactive. U441 and U435 are active and their outputs drive the X0-X11, twelve bit RGB data bus. The assertion of MSTROBE-1 latches the data present on the I0-I5 data bus into U435 of the Formatter to form the upper half of each color.

U441 duplicates the data byte into the lower half of each color to form the required 12 bit address for the Color Map ROM. The transformation looks like:

$I0 = R0 = X10 \& X8$
 $I1 = R1 = X11 \& X9$
 $I2 = G0 = X6 \& X4$
 $I3 = G1 = X7 \& X5$
 $I4 = B0 = X2 \& X0$
 $I5 = B1 = X3 \& X1$

Figure 3-16 shows this transformation.

NOTE

Each of the three color signals (RGB) have four possible densities which are identified by the setting of the two bits for that color (00, 01, 10, or 11). These four possible saturation levels are transformed into a linear level, twelve bit color space.

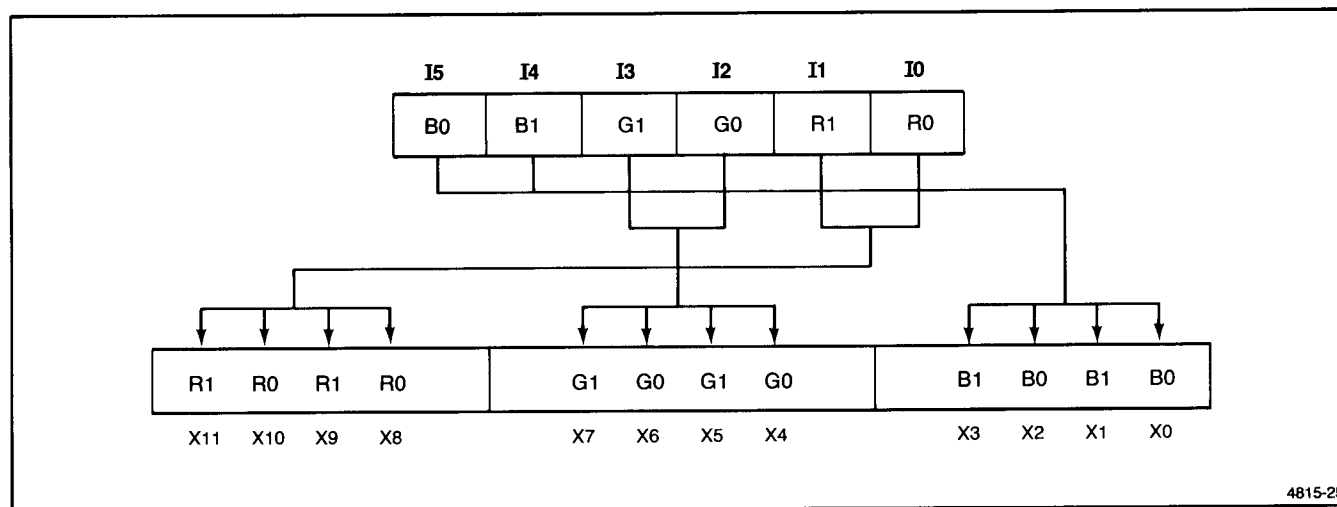


Figure 3-16. Formatter Transformation (1 Byte/Pixel Mode).

Two Bytes Per Pixel Mode. In this mode, U435 and U441 drive the X0-X11 data bus, and U431, U425 and U421 are disabled.

Two Byte/Pixel formatting is fairly analogous to One Byte/Pixel Mode formatting except that each pixel requires two bytes of data. Each byte contains 6 bits of color information so there is no requirement to duplicate or transform any of the color bits.

Figure 3-17 shows this transformation.

The 12 bits received from the host equals the twelve bits transferred to the Color Map PROM (U251). This provides eight possible color densities for each primary color.

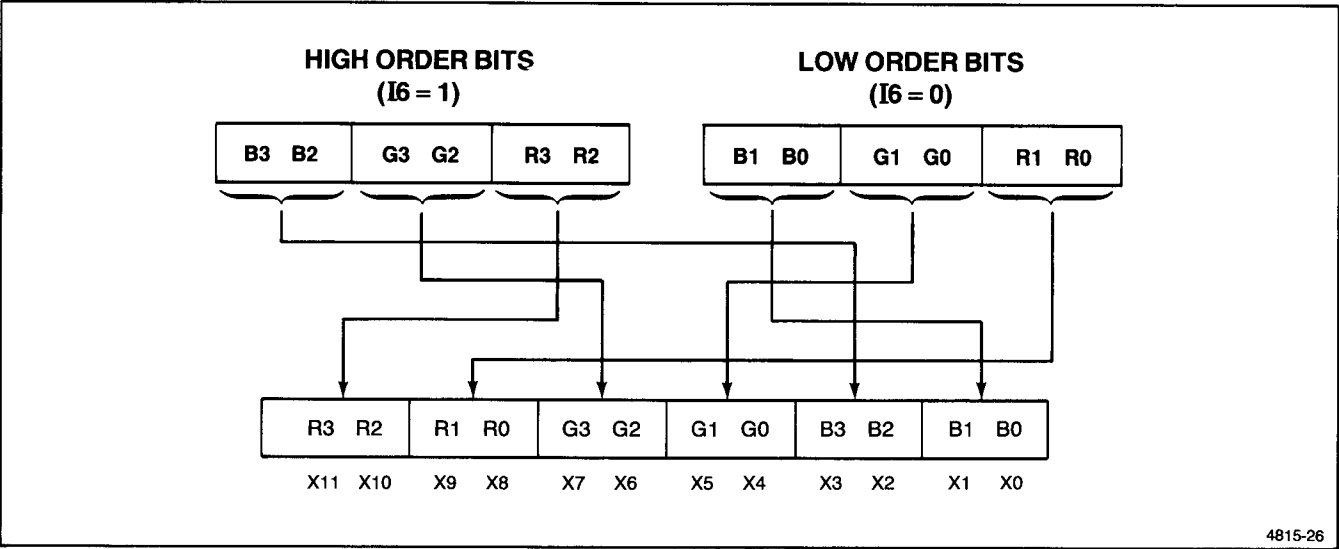


Figure 3-17. Formatter Transformation (Two Bytes/Pixel Mode).

Line Buffer

The Line Buffer consists of U261 (tri-state latch), U231 and U241 (2K × 8 static RAMs), and U351 (octal, tri-state line driver). Figure 3-18 shows the inputs and outputs of the Line Buffer.

The Line Buffer's task is to buffer the pixel data received from the Pixel Formatter and sent to the Print Engine. Pixel information (Z0 – Z7) is input to the Line Buffer and latched by STROBE-1 into U261 for presentation to the RAM (U231 and U241). The RAM is broken into two 2K × 8 blocks. At any point in time, one block will receive data from the Pixel Formatter while the other will output the previous pixel's data to the Print Engine through U351. The data is saved and retrieved on a line by line basis.

The DMA controls whether a RAM is inputting or outputting and the particular FI-FO (First In–First Out) selected by the control lines RAMHI and RAMLO. When a RAM block is written to, DMAR/(not)W is low indicating WRITE ENABLE. When a RAM block is read from the DMAR/(not)W line is high indicating data transfer to the Print Engine.

DMA

The DMA consists of U325, the DMA Controller, (Motorola MC6844) its associated logic (U121 and U125) and U205A (STROBE-1 generator). The DMA controller is configured to provide two distinct addresses to the Line Buffer. The Line Buffers are in two separate 2K blocks. These memory blocks are located at addresses 0000 to 07FF (U231) and 2000 to 27FF (U241). One of these addresses is used to write information into the Line Buffer while the other address is used to access data from the Line Buffer and send it to the Print Engine. The structure of the Print Engine requires immediate access to data and accordingly it is given highest priority by the DMA. Figure 3-19 shows the inputs and outputs of the DMA.

An important point to remember is that the Print Engine and the Interface Handshake State Machine both have access to the DMA. The Processor Kernel performs all initialization of the registers and determines which channels will be active. Thus it can inhibit the transfers to the Print Engine by setting the DMA priority control register appropriately.

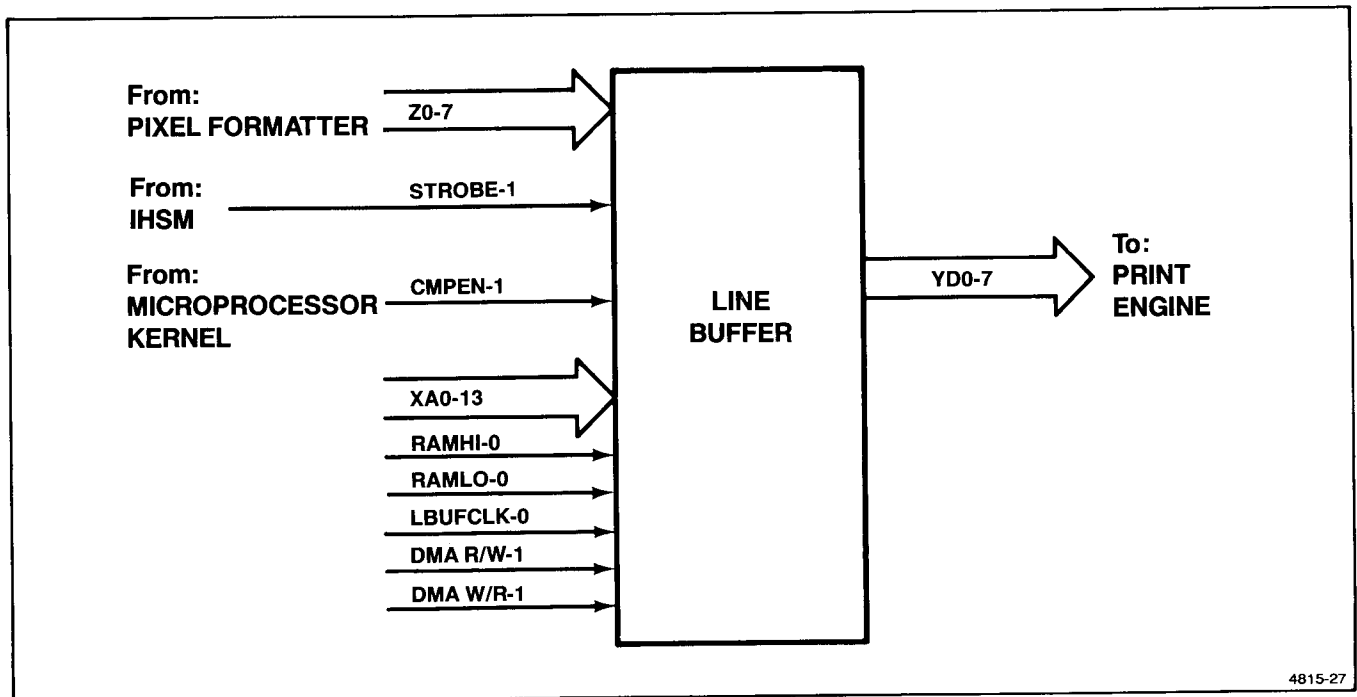


Figure 3-18. Line Buffer.

When the DMA is being shared between the Print Engine and the Interface Processor Kernel, as is the case during raster data transfer, there is only a small window during which time the Interface Processor may interrogate the DMA. This small window is inherent in sharing the DMA between the two processors. The Interface Processor window occurs between the time one raster finishes printing and before the next line begins. This time is called the "Blanking Interval." Once DGRNT-0 is deasserted, the DMA is effectively shut down and the registers are available to the Interface Processor Kernel. No data transfers may occur during this time period. If the DMA is involved in writing data from the Line Buffer to the Print Engine, and the Interface Processor desired to read the DMA registers to validate the data received from the host, interrogation of the DMA can only occur during the "Blanking Interval" time determined by the Print Engine.

The Blanking Interval occurs on a per drum revolution basis and validation of the hosts data must occur during this time period, along with the resultant "buffer ready" or "buffer not ready" transmission back to the Print Engine. The Processor Kernel performs "switching of buffers" during this Blanking Interval time period. It is accomplished by updating the byte count and changing the starting addresses for the two line buffers.

Data is stored in the Line Buffer by the DMA when STROBE-1 is issued by the Interface Handshake State Machine and DGRNT-1 is asserted. Receipt of STROBE-1 causes the DMA to output an address on XA0-XA10 and issue a write pulse. The pixel data present on Z0-Z7 is then written into the selected Line Buffer location. At the completion of the write, DONE is asserted to indicate to the IHSM that the data has been stored and the pixel transaction is complete.

Data is written out of the Line Buffer by the DMA when a DRQ-1 is received from the Print Engine. Receipt of DRQ-1 is applied to the TXRQ0 input on the DMA Controller (U325 pin 32) and causes the DMA to output a read address on the lines XA0-XA10. The DMA then issues TXSTB-0 which is anded with E-1 and TXAKA-0 to generate DACK-0 which latches the data into the Print Engine.

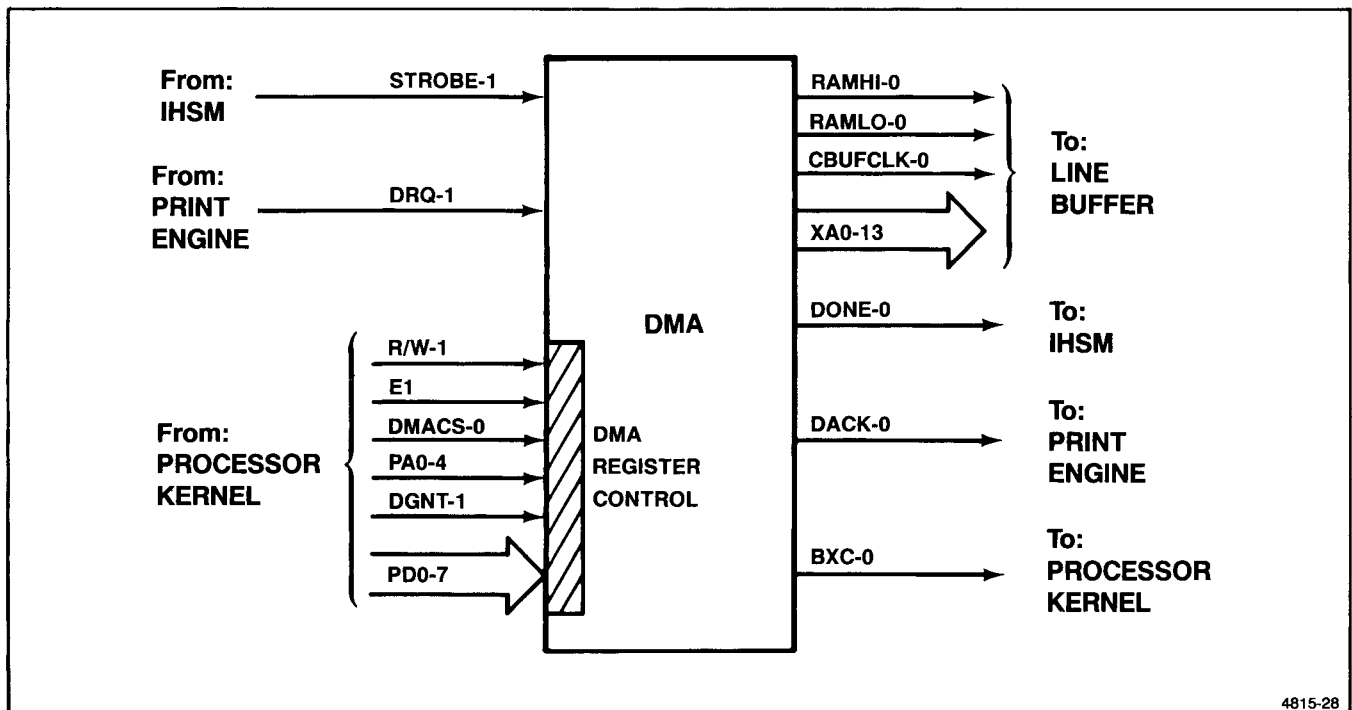


Figure 3-19. DMA.

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PROCESS CONTROL

INTRODUCTION

The Process Control is the functional heart of the color copier. After the Parallel Interface circuitry acquires, transforms and synchronizes the image data from the host, identifies the operating format, and formats the 12 bit RGB (red-green-blue) image data into a eight bit CMY (cyan-magenta-yellow) word, the pixel data is transferred to the Process Control. The Process Control manipulates the image data and generates the copier timing signals. In addition, it reads and writes to the front panel, and monitors the electro-mechanical processes and fluid levels. The Process Control Processor operates a complete and separate sub-system from the Interface Processor Kernel.

OVERVIEW

The following description of the Process Control is divided into:

- Timing and waveform generation
- Image data processing
- Inter-processor communication
- Front panel indicators and inputs
- Electro-mechanical process control

Figure 3-20 shows a block diagram of the Process Control.

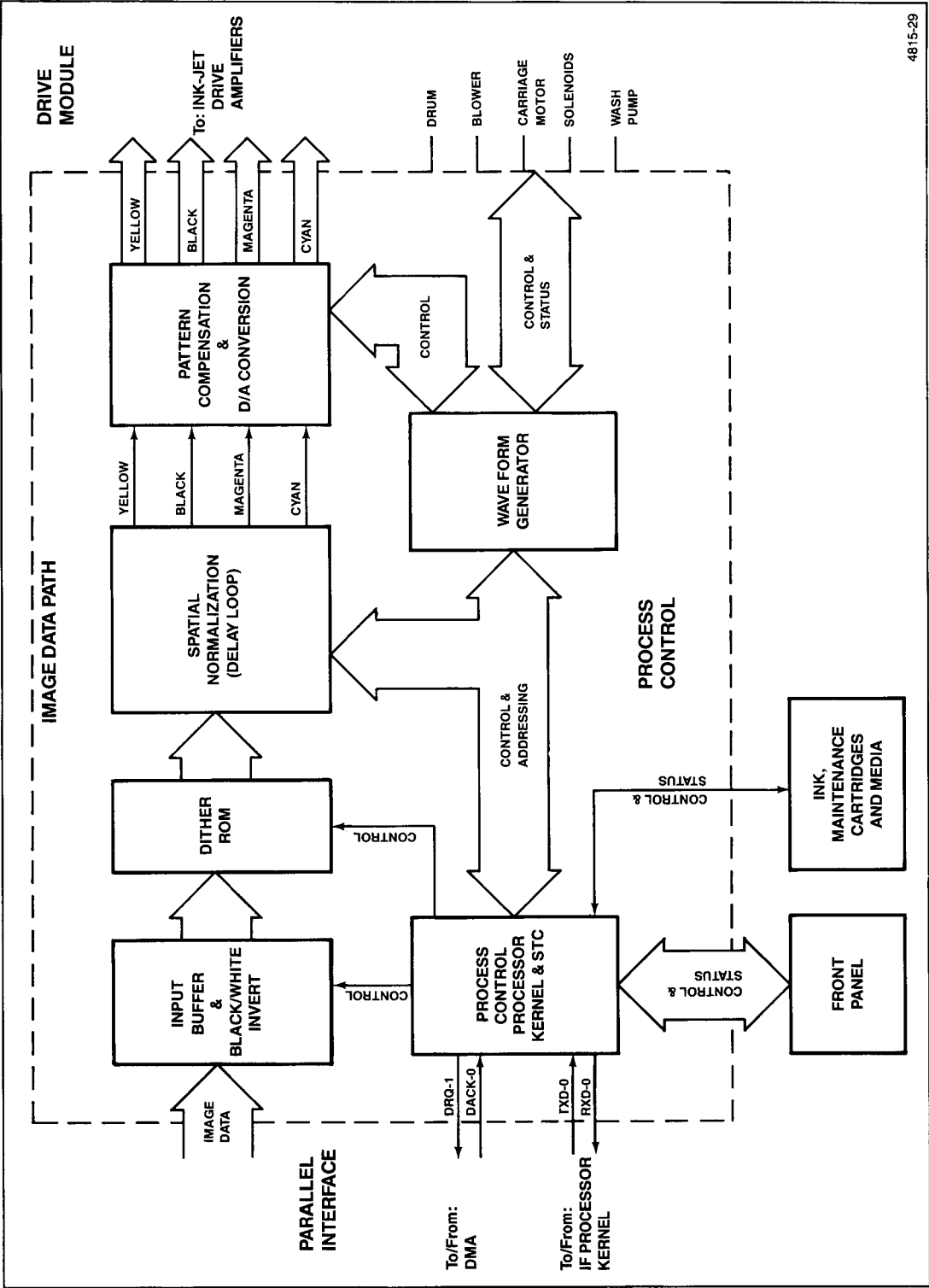


Figure 3-20. Process Controls Block Diagram.

PROCESS CONTROL/IMAGE DATA PATH TIMING

The Process Control must accomplish the tasks of directing the copier's electro-mechanical processes, sequence, and timing, and correctly time the image data to coincide with these mechanical processes. U531 (PIA#2) accomplishes this task. PIA#2 responds to interrupt requests, address/data inputs from the Processor (U121), the Blanking input from the System Timing Controller (U131), Power Fail (loss of line voltage), and abort commands when the copier senses that a process has failed during imaging. It is used to input self test conditions that aid in identifying faulty components, whether they are the electronic circuitry or the electro-mechanical devices.

TIMING AND WAVEFORM GENERATION

The 4Mhz oscillator on the Process Control board is the basis for the copier timing signals. U441 uses a 4Mhz crystal to generate the copier's basic timing signal. All other copier timing is derived from the 4Mhz signal, including the 1 MHz signals E-0 and E-1. E-0 (from the Processor) is divided down by the System Timing Controller (U131) to produce 16CK-0 and 16CK-1. 16CK is a 330Khz signal during imaging, but can change to 125Khz during testing.

The E-0 and 16CK-0 signals provide timing for the Drive Module while the signal 4Mhz connects to the clock input of the Interface Processor Kernel.

The waveform generator provides the timing signals necessary for synchronizing the functions of the Process Control/Drive Module and transferring pixel data from the Parallel Interface.

This circuitry creates the sinusoidal ink-jet drive waveform and generates timing signals that sequence pixel data through the Image Data Path. The ink-jet drive waveform is generated using a Johnson counter (U541 & U641), a "sine-weighted" D/A converter (U741) and a two-pole active filter (U745B). Timing signals are generated by decoding the appropriate outputs from the Johnson counter. Figure 3-21 shows a simplified drawing of the Timing and Waveform Generator.

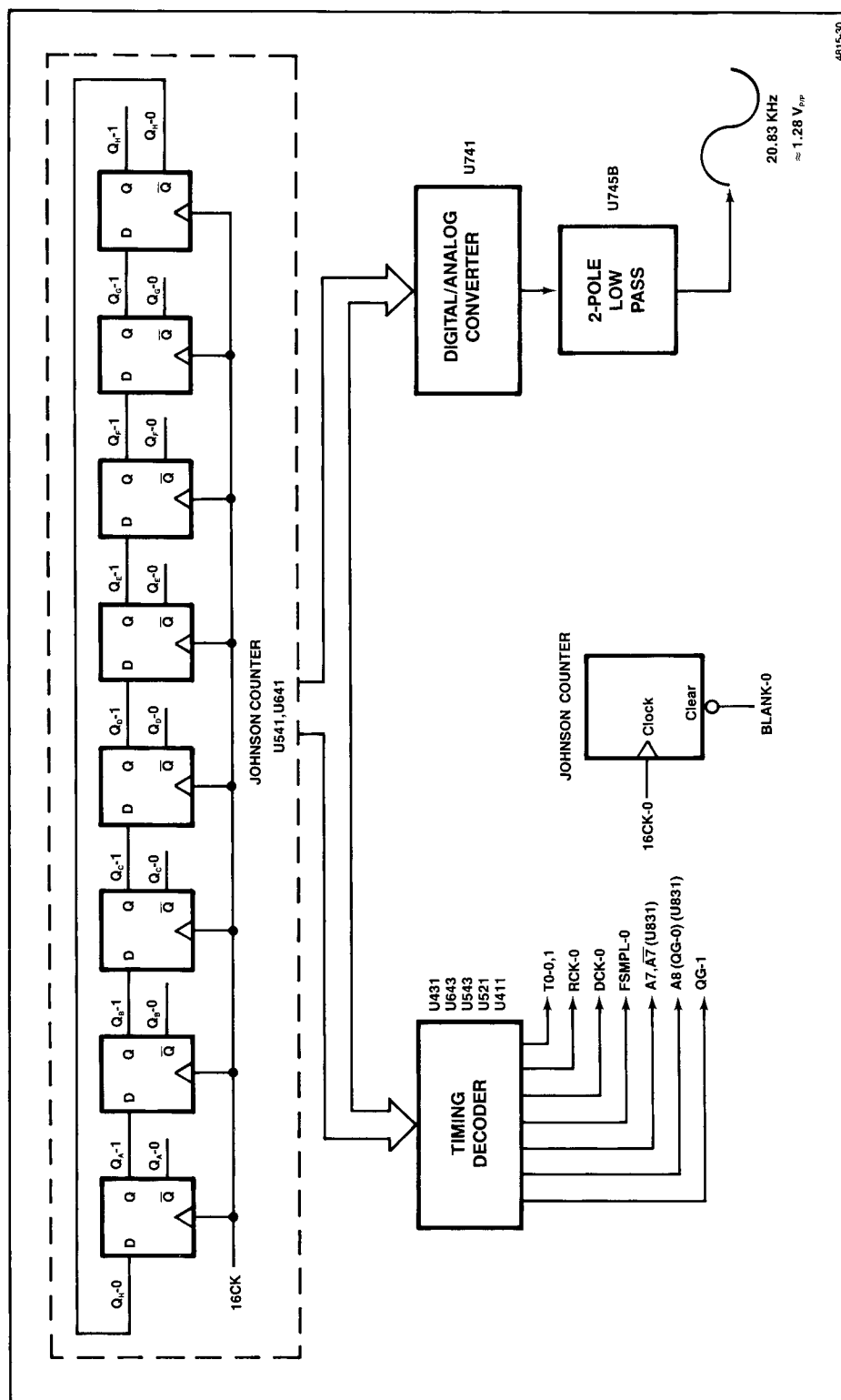


Figure 3-21. Simplified Timing and Waveform Circuit.

Waveform Generation

U541 and U641 (quad D flip/flops) form a Johnson counter. Figure 3-22 shows the timing of the output signals from the counter. 16CK clocks the signal through the counter that

directs the output of the preceding gate to the input of the next gate. This circuitry creates the sinusoidal ink-jet drive waveform and generates timing signals that sequence the pixel data through the Image Data Path.

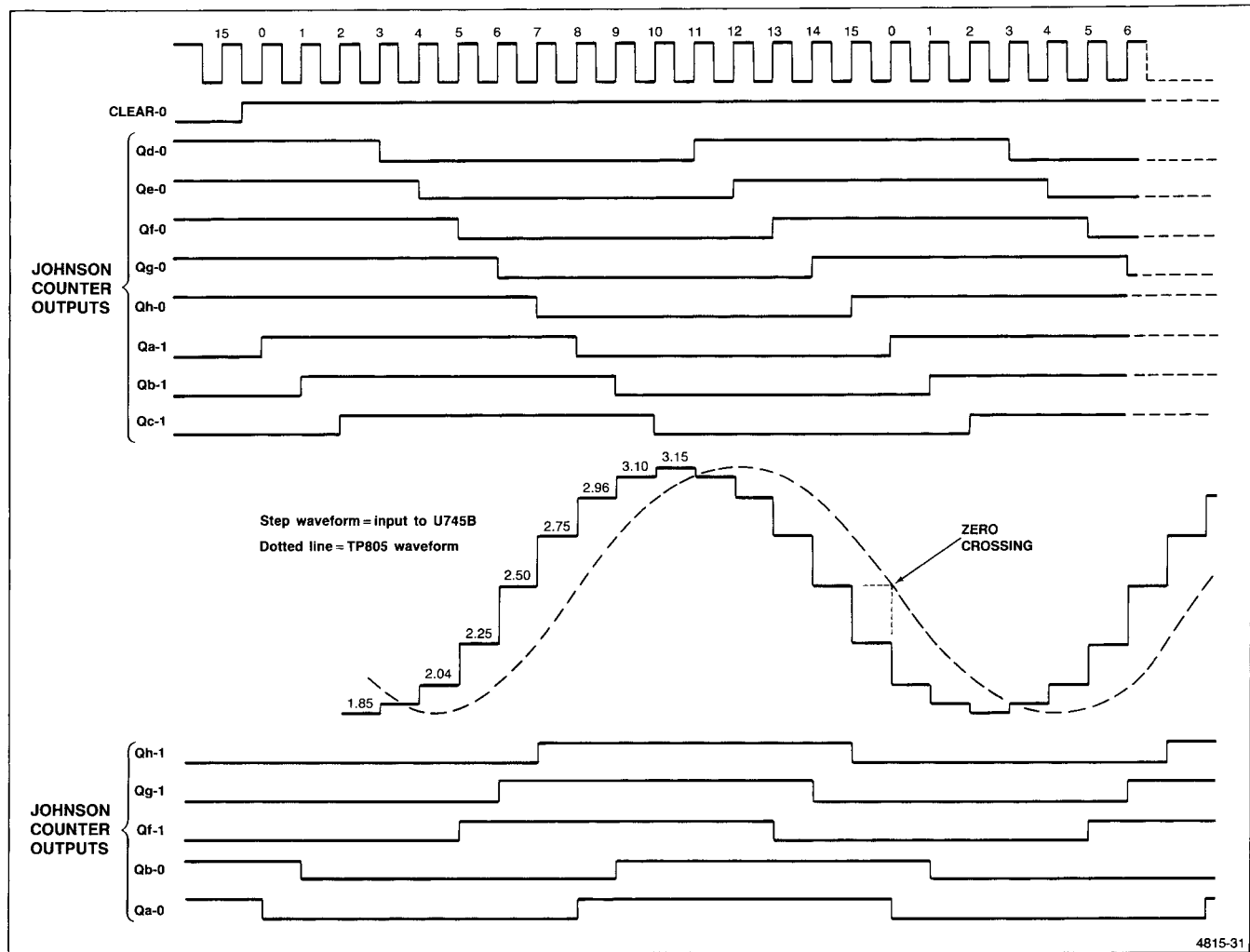


Figure 3-22. Johnson Counter Outputs.

The timing signals of U541 and U641 are used for two major purposes.

- To produce a digitally synthesized sine-wave to drive the ink-jet heads during imaging. Figure 3-22 shows how the combined Johnson counter outputs feed through U741 buffers and the “weighted” output resistors to produce the sine-wave at the input of U745. The output pins of U741 are sequenced to provide a “stair-stepped sine-wave” at the input of the two-pole active filter consisting of U745B, R744, C745 and C744. This produces a filtered (without the harmonics created by the D/A conversion) sine wave of 1.28v p/p at TP805.
- To provide required timing signals from combinations of the Johnson Counter outputs. The timing signals are listed in Table 3-6.

Table 3-6
CONTROL SIGNALS FROM
THE WAVEFORM GENERATOR

Counter Outputs Used	Control Signals Produced	Destination
Qh-1, Qf-0	HIST-0 and HIST-1	PATTERN COMP
Qg-1, Qf-1	FSMPL-0 to U101	FLUID DETECT
Qa-1, Qb-0	TO-0/TO-1	TIMING CLOCK
Qa-0, Qe-0, 16CK	RCK-0	REGISTER CLK
Qa-0, Qh-0, 16CK	DCK-0	DOT CLOCK
Qd-0, Qe-0, Qf-0, Qg-0, Qh-0, Qa-1, Qb-1, Qc-1	Inputs to sine wave D/A converter	Ink-jet drive signal

The sine wave output at TP805 is amplitude modulated and gated by the four color specific D/A converters (U713, U717, U723, and U727). The amount of modulation and gating is determined by the Pattern Compensation ROM (U831) and the input pixel data. The D/A converters operate in voltage mode (the DAC's output is voltage referenced on pin 15) which minimizes the effects of digital switching feeding through to the output. Data on the inputs (D1-D7) varies the maximum voltage at pin 15, thus allowing amplitude modulation of the sine wave to drive the ink-jet head amplifiers. The pots R705, R801, R803, and R805 allow adjusting the output of the DACs to optimize the drive voltage for each ink-jet head.

Signal Descriptions

DCK-0: The rising edge of DCK-0 (TP327) occurs at “zero” crossing on the negative slope of the filtered sinewave output at TP805. DCK-0 is the reference clock for pixel data flow through the Image Data Path. It is used for Dither ROM addressing and Spatial Normalization.

FSMPL-0: This signal enables U101 for sampling the selected fluid level voltage during the active portion of the ac reference voltage derived from QG-0.

Qg-0 and HIST-1: are connected to the A7 and A8 inputs of U831. They select which of the four color Pattern Compensation ROM data planes are used and which associated History Register (U841, U843, U845, or U743) is enabled as shown in Table 3-7. The timing diagram at the bottom of Figure 3-23 reflects the data in Table 3-7.

QG-0 is also buffered and used as the ac reference voltage for the Fluid Level Detection circuitry.

Table 3-7

PATTERN COMPENSATION ROM DATA PLANE ENABLES.

A8	A7	Color Plane	Register Selected
0	0	Yellow	U841
0	1	Magenta	U845
1	0	Black	U843
1	1	Cyan	U743

T0-0,1: These signals are active at “zero crossing” on the negative slope of the filtered sine wave output. “Zero” occurs at about 620mV when measured at TP805. The present state of the Johnson counter at T0-0 on the inputs of U741 is:

QD-0	QE-0	QF-0	QG-0	QH-0	QA-1	QB-1	QC-1
H	H	H	H	H	H	L	L

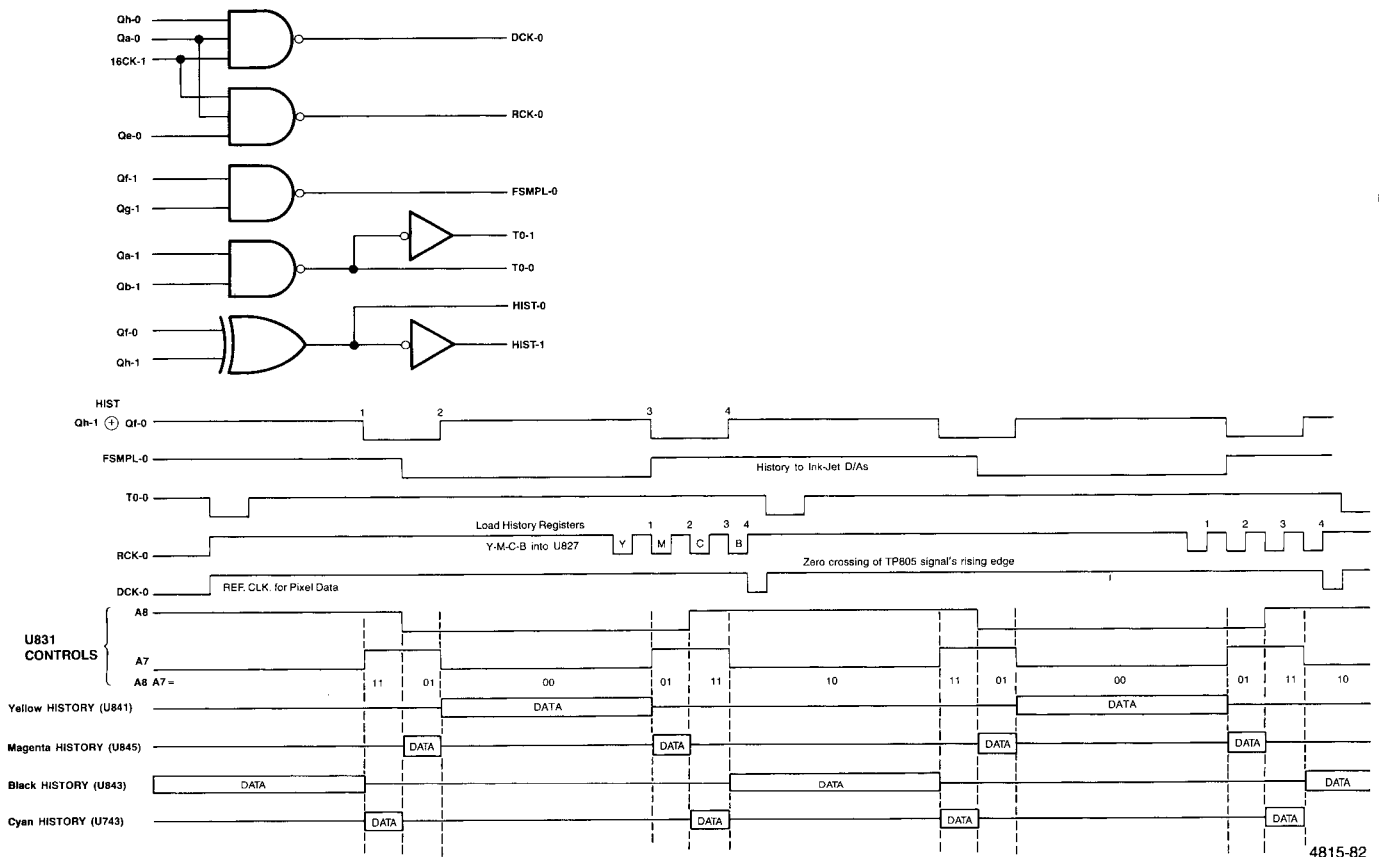


Figure 3-23. Timing Signals for Process Control.

T0-1 controls the WRITE-0 input for all four (U713, U717, U723, U727) ink jet drive amplitude modulated D/A converters. This ensures that data to the D/A converters is written only at “zero” crossing to maintain a consistent sinusoidal drive waveform to the ink jet heads. T0-0,1 are also used for timing in the Spatial Normalization circuitry.

RCK-0: RCK-0 is used to step Pattern Compensation ROM data through the four data formatting registers made up of U827, U817, U823, and U813. A series of four RCK-0 pulses cause amplitude data to be presented at the inputs of the four D/A converters. Data is then written at T0-0. Refer to Figure 3-23.

SYSTEM TIMING CONTROLLER

U131, the 9513 System Timing Controller (STC), provides Processor control and monitoring of the head carriage movement, blower motor/vacuum system, drum speed and synchronization, image justification, and stripper solenoid timing.

Internally, the STC includes five general-purpose 16-bit counter groups. Each counter group performs a controlled up or down count which may be READ by the Processor without disturbing the count in process. In this way the Process Control Processor monitors the ongoing copy. Figure 3-24 shows a simplified drawing of the inputs and outputs of the five counters. Table 3-8 details the function of each counter group.

Table 3-8
SYSTEM TIMING CONTROLLER COUNTER USAGE

Counter	Function Controlled	Description
1 & 2	Carriage movement	Controlled accelerate and decelerate. Positioning.
3	Blower/vacuum	Velocity (air flow rate).
4	Drum Servo Velocity Reference	Determined by image resolution.
5	Drum synchronization Image justification, Stripper timing	Provide BLANKing signal for image and drum timing. Energize stripper solenoid.

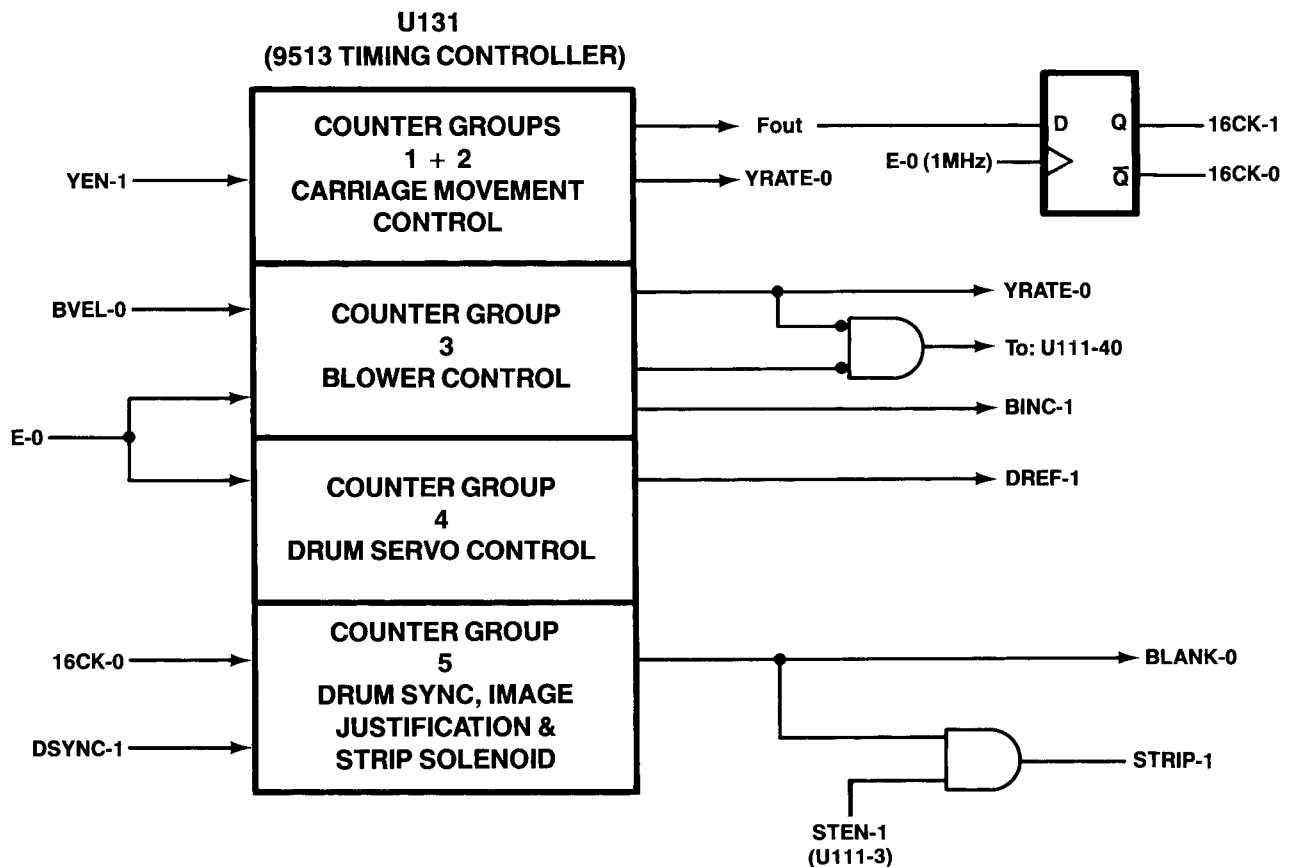


Figure 3-24. System Timing Controller Block Diagram.

Carriage Motion Control

The copier requires three modes of carriage control:

- Rapid traverse with controlled acceleration and deceleration for moving the carriage to the first image line and returning the carriage to the HOME position.
- Slow traverse for positioning the ink-jet heads over the head maintenance area during power-up and purge.
- A controlled start/stop carriage movement during imaging referred to as a "Programmable Lead Screw" with position accumulator. This allows the Processor to interrupt the copy in process synchronous with the beginning of a line, and restart imaging with the correct data at the proper place.

Implementation. *Rapid traverse* mode employs counter group 1 as a programmable rate generator and counter group 2 as a change in position (delta position) register.

The Processor maintains the velocity ramp pointer with interrupt driven velocity profiling. This pointer will increment/decrement during acceleration/deceleration on a per position basis, using a velocity lookup table. The Processor will be interrupted only during the accelerate/decelerate segments of a move.

Slow traverse utilizes counter group 1 as a programmable rate generator which is enabled by the Processor or optionally by counter group 2. In the optional implementation using counter group 2, the delta distance is loaded into counter 2 and then decremented at counter group 1 TC rate. When delta has been exhausted, TC2 disables counter 1.

The *Programmable Lead Screw* function is implemented using counter group 1 as the rate scaling function and counter group 2 as the position accumulator. Counter group 1 scales 16CK (16 times dot clock) in response to the copy resolution desired by the host, and provides a helical scan of the imaging drum at the desired pitch. YEN-1 provides synchronous gating of the carriage motion.

Counter group 2 performs head carriage position accumulation (Y-axis position updating). Counter group 1 generates this rate information, and counter group 2 maintains a position count thus relieving the Processor of maintaining the Y-axis position count update. Once the carriage is indexed to the first image line, counter group 2 is loaded with the current Y-position. Now the counter is armed and begins to accumulate the Y-position count. At the end of the image, the Processor issues a "disarm and save" command to counter group 2. The counter then save the contents of the position accumulator in a HOLD register which is readable by the Processor by interrogating the counter group 2 HOLD register.

Blower Velocity Control

It is necessary to vary the speed of the blower motor to compensate for variations in air density (change in altitude). The vacuum switch mounted on the right end of the drum is a bi-level switch calibrated to activate at a desired differential pressure. This counter operates in two modes. First, during initial power-up, the counter operates in "slew mode" until the preset pressure is reached. The counter contents are then used in "reference mode" for maintaining the blower speed and air pressure.

Slew mode- During power-up, the media handling system (blower) is slewed at a self-limiting rate while the Processor monitors the vacuum switch.

Reference mode- When the the blower attains the desired pressure, the vacuum switch closes, and the contents of counter 3 are placed in the counter 3 HOLD register. The Processor reads this value, and uses this value to provide a reference for the blower servo. The output of this comparison (BVEL-0) varies the blower velocity to yield the proper pressure.

Drum Servo Velocity Reference

The drum velocity and direction are under Processor control. The variable resolution (128 to 159 dots per inch) determines the variable drum speed (792.5 to 658.7 RPM). The signal, DREF-1, provides the scaling factor required to control the drum servo drive.

The drum servo feedback provides twelve pulses per drum revolution.

Drum Synchronization / Image Justification / and Strip Solenoid Timing

The copier must provide blanking timing (analogous to raster scan horizontal blanking) to inhibit the ink-jet heads during the nonprinting portion of the drum revolution. BLANK-0 is generated by a count of clock pulses (16CK-0) and initiated by DSYNC-1 (beginning of image).

16CK-0 (clock) and DSYNC-1 (drum sync) control *drum synchronization* and *image justification*. The falling edge of DSYNC-1, which coincides with the leading edge of the media arriving at the printing position of the yellow head, initiates an image scan line.

The Processor uses counter group 5 to identify the leading edge, the image area and the trailing edge of an image, by loading a constant into the counter group 5 LOAD and HOLD registers. The constant in the LOAD register identifies the leading and trailing margins of the media sheet. The constant in the HOLD register identifies the imaging area.

The process is:

1. The constants are specified as $16 \times \text{dots/revolution}$.
2. After a software "arm and load" command, the counter is triggered on the next falling edge of DSYNC-1.
3. The counter output remains low for the duration of (LOAD \times 16CK). When this count reaches zero (duration of leading edge margin), the counter output goes high.
4. The output remains high for the duration of (HOLD \times 16CK) (duration of image line). When this count reaches zero, the counter output goes low, and remains low until the next falling edge of DSYNC-1. This time interval constitutes the trailing margin on the media.

To provide *stripper solenoid timing*, the Processor must consider the drum velocity and the solenoid mechanism delay. The Processor uses counter group 5 to provide a delayed enable for activating the stripper solenoid (initiated by the falling edge of DSYNC-1). The Processor waits until the the stripper pawl aligns with the exposed part of the drum, then activates and holds the stripper solenoid for about 120 degrees of drum rotation to strip the media. The 120 degree figure is determined by the stripper being disabled before the drum index tab is reached. The signal STEN-1 (U111 pin 3) qualifies the strip solenoid activation.

IMAGE DATA PROCESSING

The Image Data Path coincides the pixel information received from the Parallel Interface with the timing of the internal processes of the copier. The result is a complete, representative facsimile of the information sent by the host computer or terminal. The copier timing circuitry controls the ink-jet heads while taking into account the image resolution, the drum rotation speed, the head carriage location, and the relative position of the individual ink-jet heads. Thus, the ink-jet head drive circuits correctly output ink from one or all the heads at the correct pixel location. Figure 3-25 shows a block diagram of the Image Data Path.

The sub-processes involved in image data processing are:

- **BLACK/WHITE INVERT** control is a user defined bit that allows images to be printed on either a black or white background independent of the image background on the terminal CRT.
- **DITHERING** is the process used to produce 208 of the 216 possible copier colors. It is accomplished by overlaying cells of different primary dot densities ~~and primary~~ colors, which when combined, yield different perceived colors. *ind*
- **SPATIAL NORMALIZATION** is the process algorithm which compensates for mechanical variables which include the ink-jet head spacing (about .77 inches apart), and the copier's variable resolution (128-158 dots/inch) which varies the drum speed. The higher the resolution, the lower the drum velocity, and the lower the drum velocity, the longer the time delay between a fixed point on the drum passing beneath each ink-jet heads. The Spatial Normalization circuitry delays the pixel data to the black, magenta, and cyan heads to compensate for the physical spatial offset of these ink-jet heads with respect to the yellow ink-jet head.
- **PATTERN COMPENSATION** The Pattern Compensation circuitry attempts to compensate for ink-jet head printing anomalies that occur in response to past and future ink-jet head activity.
- **D/A CONVERSION** for each head allows the waveform generated at TP805 to be amplitude modulated in accordance with the Pattern Compensation data.

THEORY OF OPERATION

Image Data Processing Theory

The following information details the steps in each of the sub-processes that make color imaging possible.

Black/White Invert Control. When BWI-0 is asserted, U515 (FPLA) causes black and white data from the Dither ROM to be inverted if either all ones or all zeros are presented at the inputs of U515. Inversion is accomplished with exclusive OR (XOR) gates (U431) used as programmable inverters. Black data from the Dither ROM is normally inverted. When BWI-0 is not asserted, the output of U515 is high which causes the output of the XOR gates to invert black data from the Dither ROM. Thus, the black data is double inverted providing uncomplemented data to the Nibble Select (U421). When BWI-0 is active, the XOR gates do not cause an inversion and the black data to U421 is inverted.

Dithering. Dithering refers to the process of organizing color data into a series of color dots that visually represent 208 of the 216 possible colors. The output of the Dither ROM defines the color of each pixel. The eight colors that do not require dithering are:

- Additive color primaries—red, blue, and green
- Subtractive color primaries—cyan, magenta, and yellow
- Black (absence of color)
- White (all colors)

All other colors are produced by using a process very similar to the process used to print color pictures in newspapers or color photographs. In both examples, the image consists of a series of accurately placed color dots (pixels) that, viewed from a distance, appear to combine to form another color.

Before explaining dithering, a review of the function of the Color Map PROM (U251) on the Parallel Interface board is in order. The Color Map receives the parallel, twelve bit RGB (red-green-blue) color data from the driving host, and translates it into an eight bit CMY (cyan-magenta-yellow) “weighted” color number. The description of dithering contains an explanation of color weighting.

U321 (Dither ROM) stores the algorithm necessary for manipulating encoded pixel data from the Parallel Interface input and outputting the individual color information for printing. The partial schematic in Figure 3-26 shows the circuitry associated with the Dither ROM. The pixel data (YD0-YD7) is input to U511 (data register) and passed to U515 (Black/White Invert) and U321 (Dither ROM).

Each data byte (LD0-LD7) is a binary coded word defining the color of one pixel. This word is translated into a dither cell by the Dither ROM. A dither cell is a four by four pixel matrix.

Dithering is the process of simulating analog color levels by means of varying pixel density (dot size) and colors within a specific area on the media. Data is presented to the Dither ROM in the form of a color number (A3 – A10). A1 and A2 from U443 address the X-axis (axis of drum rotation) location and A0 (from U331-PIA#2) combined with DY0 address the Y-axis location (direction of carriage travel during imaging).

Each color number (0 – 215) represents a unique color combination of Cyan, Magenta, Yellow or Black ink. Each primary has six definable color levels which are decoded by the Dither ROM to produce six (0-5) levels of pixel density. A total of 216 (6 cubed) different colors can be produced by super-imposing these pixel density patterns or “dither cells” on the media.

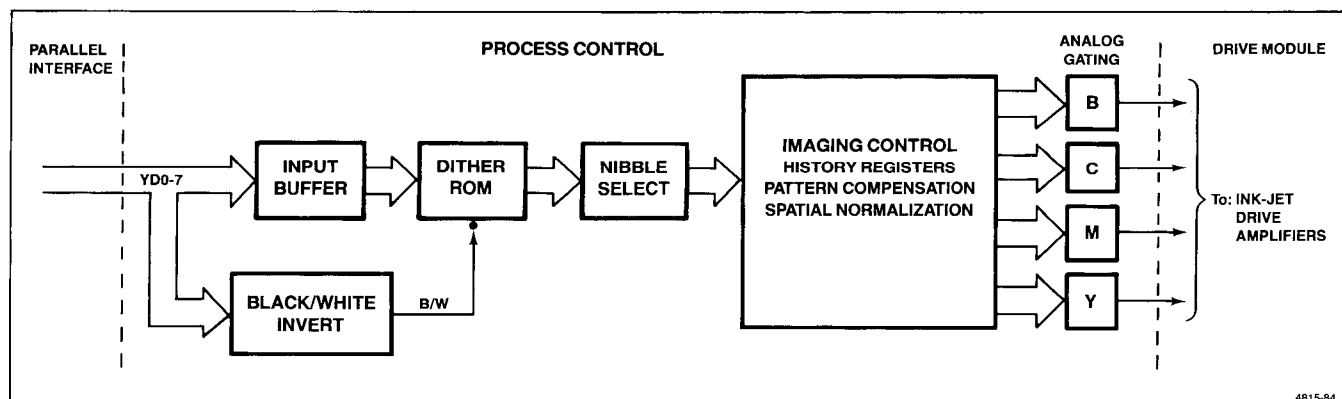


Figure 3-25. Image Data Process Block Diagram.

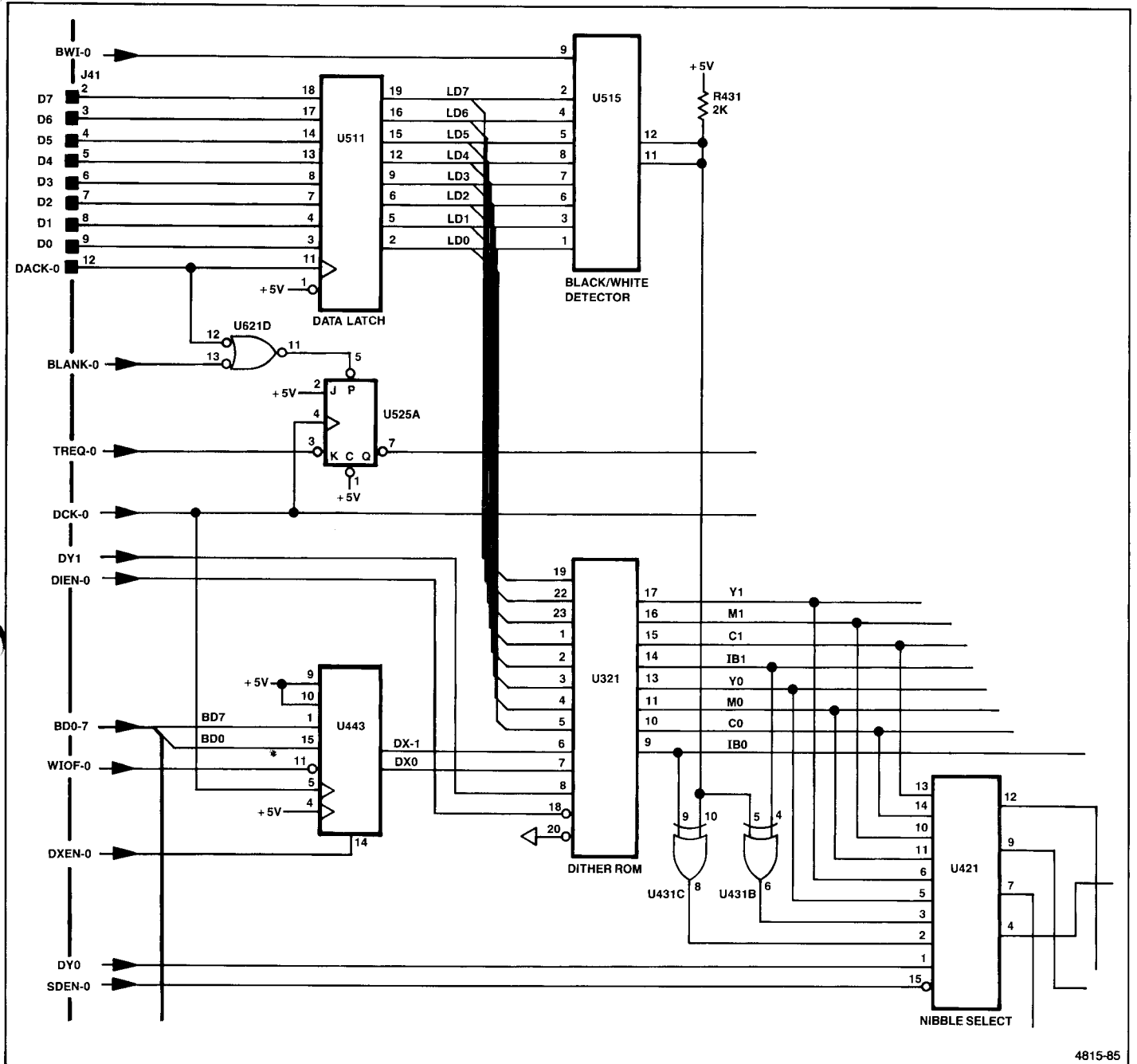


Figure 3-26. Dither ROM Circuitry.

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THEORY OF OPERATION

The Dither ROM decodes the color number based on the following weighting for each primary:

$$\text{Color \#} = (6^2 \times \text{Cyan}) + (6^1 \times \text{Magenta}) + 6^0 \times \text{Yellow}$$

For example, if a particular color consists of "level 2" Cyan plus "level 4" Magenta plus "level 4" yellow, the color number would be 100 (decimal).

Color #	=	CYAN	+	MAGENTA	+	YELLOW
	=	(6 ²)(2)	+	(6 ¹)(4)	+	(6 ⁰)(4)
100	=	72	+	24	+	4

The copier prints with black ink for one of two reasons. Either the color data contains black information or one of the dithered colors contains high levels of cyan, magenta and yellow. When all three colors exist in high levels (generally level 4 or 5), the dither ROM subtracts equal portions of each color and replaces them with a replacement value of black. This process is called "black extraction." For an example, we'll use the color number 208 (decimal).

Color #	=	CYAN	+	MAGENTA	+	YELLOW
208	=	(6 ²)(C)	+	(6 ¹)(M)	+	(6 ⁰)(Y)
208	=	(6 ²)(5)	+	(6 ¹)(4)	+	(6 ⁰)(4)

If level 4 cyan, magenta and yellow are "black extracted" from this example, the color output to the media would be:

Color #	=	CYAN	+	MAGENTA	+	YELLOW
208	=	(6 ²)(C)	+	(6 ¹)(M)	+	(6 ⁰)(Y)
208	=	(6 ²)(5)	+	(6 ¹)(4)	+	(6 ⁰)(4)
208	=	(6 ²)(1)	+	(6 ¹)(0)	+	(6 ⁰)(0)
		+ level 4 black				

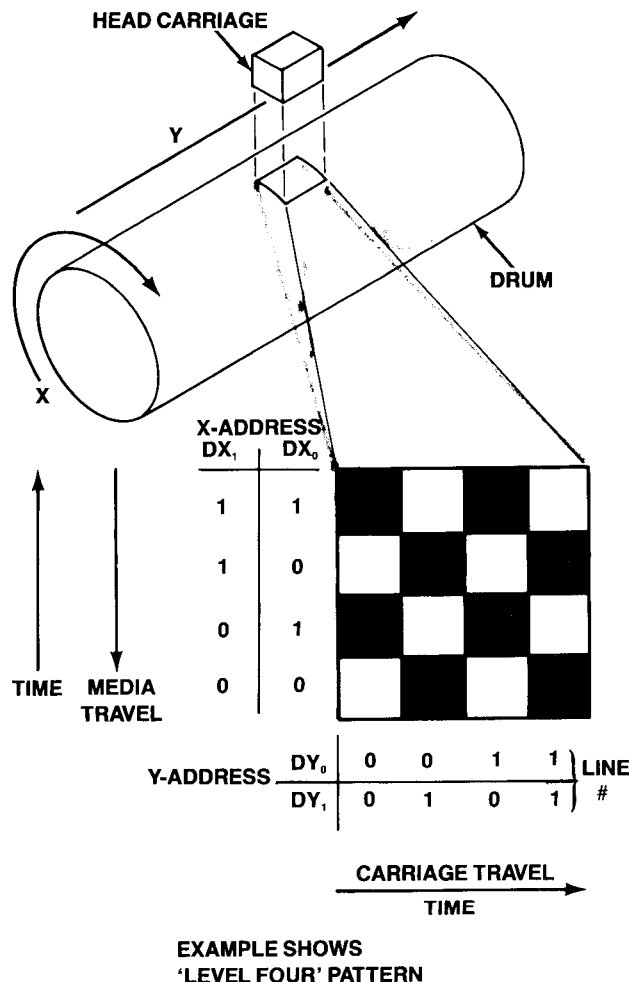
The result is:

$$208 = \text{level 1 (cyan)} + \text{level 4 (black)}$$

Dithering requires a four by four pixel matrix to display any of the 208 dithered colors. The levels of color are produced by populating a dither cell, which consists of four pixels on the X-axis (direction of drum rotation) and four pixels on the Y-axis (direction of carriage movement) per cell. Each pixel represented by a color number containing non-saturated (not full density) primaries is represented on the media by this 4x4 matrix (dither cell). Fully saturated colors (black, white, red, blue, green, magenta, cyan and yellow) are not dithered.

The X-axis address is generated by the counter U443 and clocked by DCK-0, which is initialized at the beginning of each scan line. The Y-axis address is incremented by the Processor on a per line basis.

A dither cell requires eight bytes of ROM to be accessed for one color number. Data from the ROM is formatted into two nibbles (selected by U421). Each nibble contains pixel data for each primary (yellow, magenta, cyan and black). If DY-0 is high, the upper nibble (D4-D7) is selected. By incrementing DX0, DX1 and DY0, DY1, each of the 16 nibbles (8 bytes) required for a cell are accessed in the proper order to create a dithered cell on the media. Figure 3-27 shows how the X and Y coordinates are addressed on the media.



4815-86

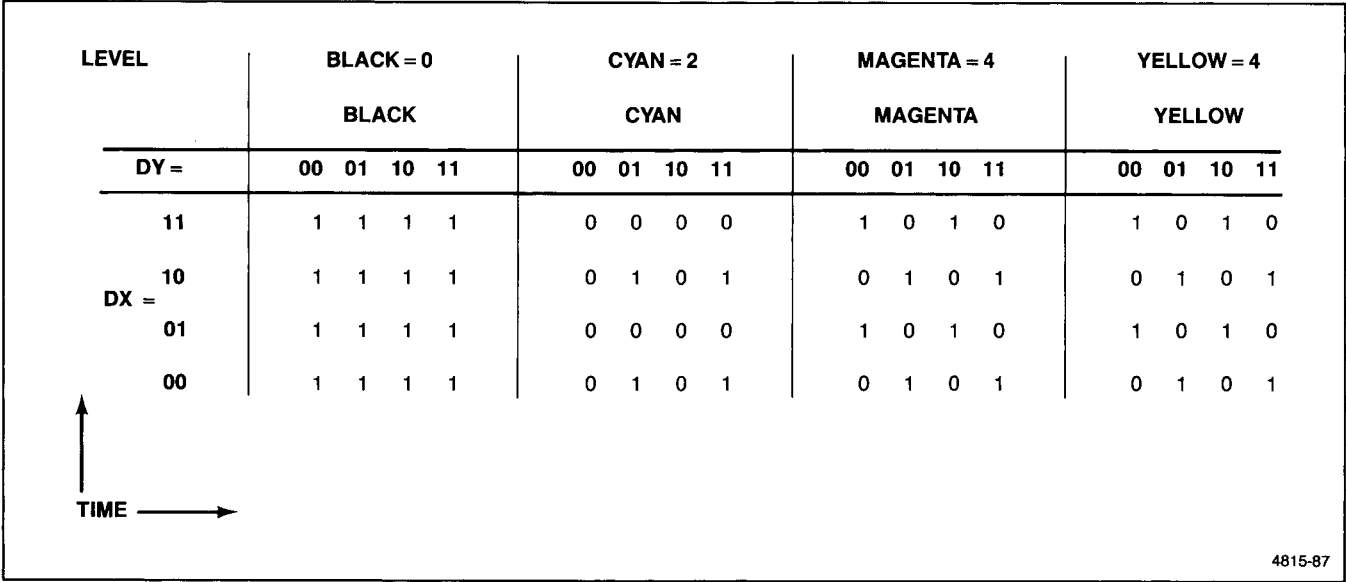
Figure 3-27. Dither Cell Addressing on the Media.

The example in Figure 3-28 illustrates the process of dithering the color number 100, and placing it into a 4x4 dither cell.

Color # = CYAN + MAGENTA + YELLOW
 100 = (6²)(C) + (6¹)(M) + (6⁰)(Y)
 100 = (6²)(2) + (6¹)(4) + (6⁰)(4)

NOTE

This color contains no black information. Since black is normally inverted, this is shown with a black dither pattern containing all ones.



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Figure 3-28. Dithering Example.

THEORY OF OPERATION

The dither patterns for color number 100 look like this.¹

¹For cyan, magenta and yellow, "1" = presence of a dot.
For black, "0" = presence of a dot.

These patterns are superimposed to yield the color output on the media for color number 100 (decimal).

Refer to Figure 3-29 for the Dither ROM addressing scheme.

	DCK-0	A2 DX1	A1 DX0	A0 DY1	NIBBLE SELECT DY0	LOC	NIBBLE	DOT #	LINE #
	0	0	0	0	0	0	Lower	0	0
	1	0	1	0	0	2	"	1	0
	2	1	0	0	0	4	"	2	0
1	3	1	1	0	0	6	"	3	0
	0	0	0	0	1	0	Upper	0	1
	1	0	1	0	1	2	"	1	1
	2	1	0	0	1	4	"	2	1
2	3	1	1	0	1	6	"	3	1
	0	0	0	1	0	1	Lower	0	2
	1	0	1	1	0	3	"	1	2
	2	1	0	1	0	5	"	2	2
3	3	1	1	1	0	7	"	3	2
	0	0	0	1	1	1	Upper	0	3
	1	0	1	1	1	3	"	1	3
	2	1	0	1	1	5	"	2	3
4	3	1	1	1	1	7	"	3	3

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Figure 3-29. Dither ROM Addressing Example.

When the color number 100 is presented to the Dither ROM (A3-A10 inputs), eight locations (A0-A3) are accessed to create the dither cell.

BINARY DATA	HEX ADDRESS	320	321	322	323	324	325	326	327
	HEX DATA	F 1	F 1	1 D	1 D	F 1	F 1	1 D	1 D
	YELLOW	1 0	1 0	0 1	0 1	1 0	1 0	0 1	0 1
	MAGENTA	1 0	1 0	0 1	0 1	1 0	1 0	0 1	0 1
	CYAN	1 0	1 0	0 0	0 0	1 0	1 0	0 0	0 0
BINARY DATA	BLACK	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
	NIBBLE	H L	H L	H L	H L	H L	H L	H L	H L

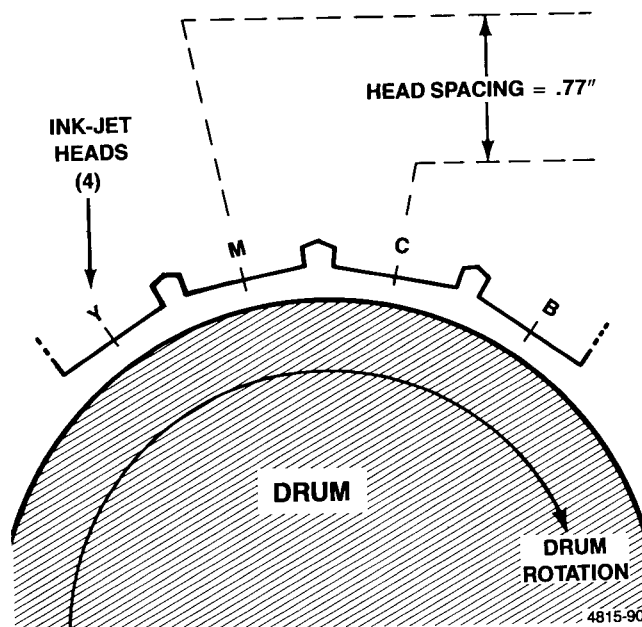
The CYAN (only) dither cell pattern would look like Figure 3-30.

Ø 326L	Ø 326H	Ø 327L	Ø 327H
Ø 324L	1 324H	Ø 325L	1 325H
Ø 322L	Ø 322H	Ø 323L	Ø 323H
Ø 320L	1 320H	Ø 321L	1 321H

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Figure 3-30. Dithering Cell.

Spatial Normalization. Spatial Normalization refers to the process algorithm which compensates for mechanical variables. It takes into consideration that each ink-jet head is about .77 inches apart and the copier's variable resolution capability (128 — 158 dots/inch) varies the drum speed. The higher the resolution, the lower the drum velocity, and the longer the time delay between a fixed point on the drum passing beneath each of the ink-jet heads. The Spatial Normalization circuitry delays pixel data to the black, magenta, and cyan heads to compensate for the physical mechanical spacing (about .77") of the ink-jet heads with respect to the yellow head. Refer to Figure 3-31.



4815-90

Figure 3-31. Simplified Spatial Normalization.

THEORY OF OPERATION

Figure 3-32 shows a simplified drawing of the Spatial Normalization circuit. The delay time period is set by writing the 2's complement of the desired number of pixels per delay to the latch (U343). For example, if the copier resolution is 154 DPI (Dots per inch) and the mechanical distance between heads is .77". The number of pixels per delay equals $(.77")(154 \text{ DPI})$ or 119 pixels.

2's complement of $[119] = (2^7 - 119) = (128 - 119) = 9$.
Thus a 9 is sent to latch U343 at the rising edge of WIOE-0.

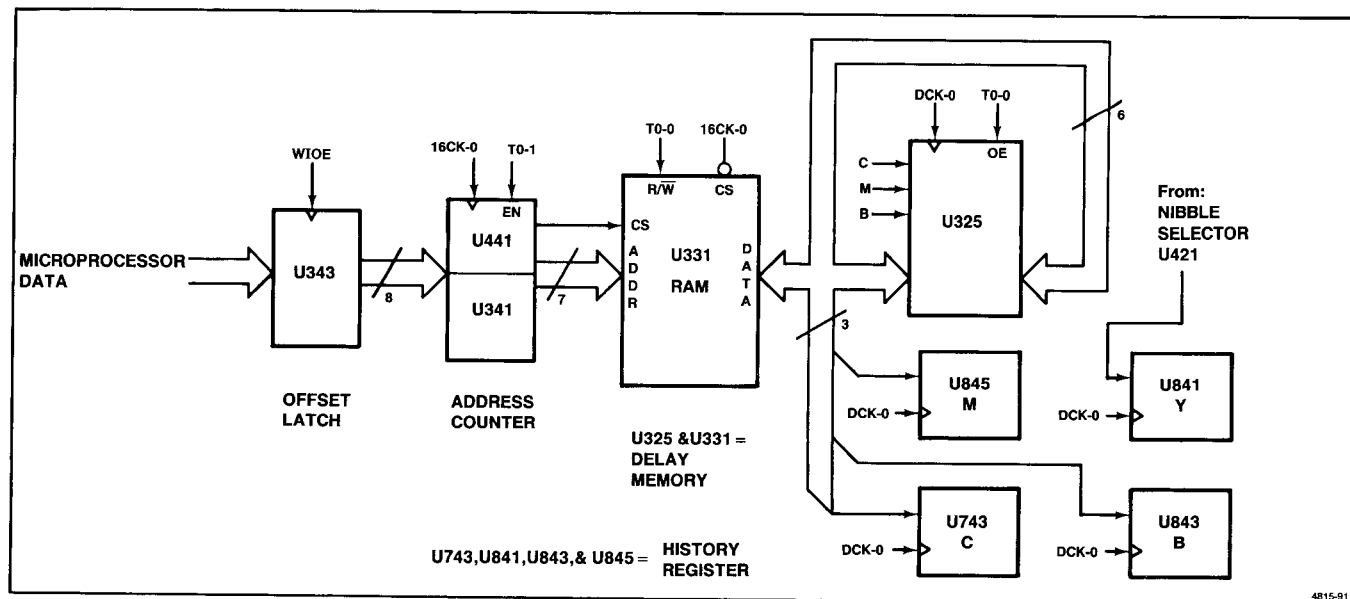


Figure 3-32. Spatial Normalization Circuit.

Magenta data passes through the delay loop once, cyan data twice and black data three times. The multiple passes are accomplished by latching the serial data of a color into U325 and feeding the data back into the delay memory (U331). Figure 3-33 shows a simplified drawing of the delay loop.

Table 3-9 details the circuit signal names.

Table 3-9

SPATIAL NORMALIZATION OUTPUT

Color	Spatial Norm Output	Serial Signal Name
Black	DD5	SERB-1
Magenta	DD0	SERM-1
Cyan	DD2	SERC-1
Yellow	SERY	SERY-1

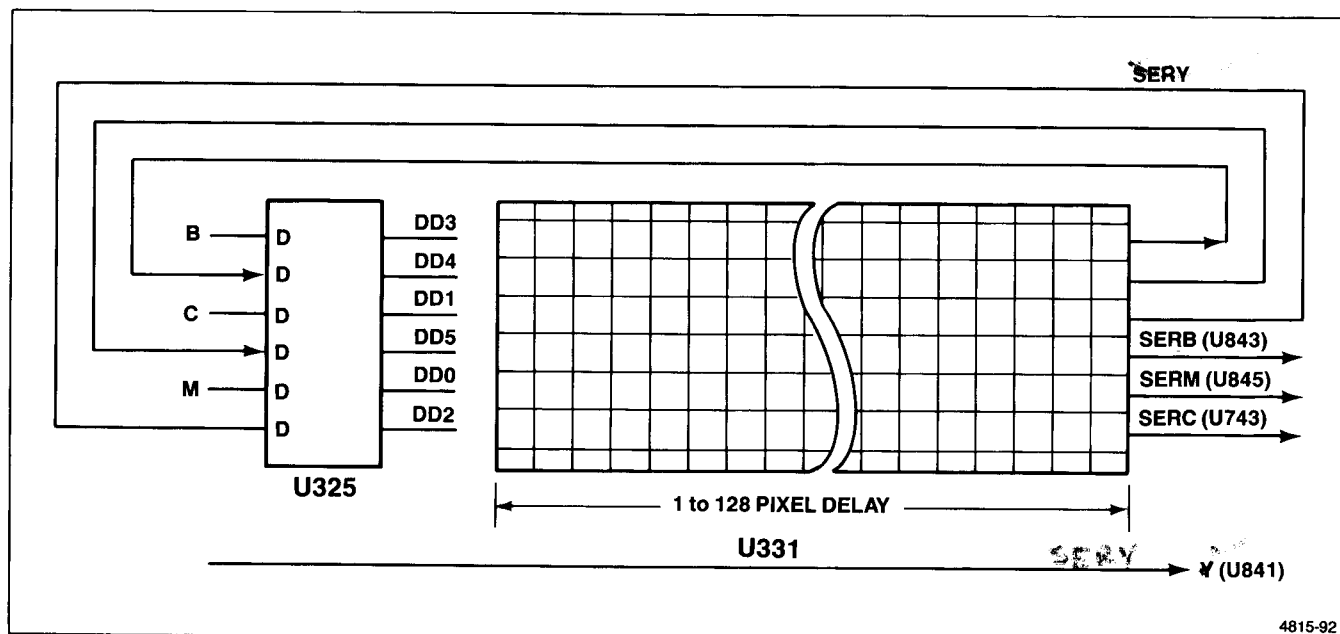


Figure 3-33. Delay Loop Functional Diagram.

THEORY OF OPERATION

Data from the Nibble Selector U421 is latched by U325 at DCK-0's rising edge. Data from the Delay Memory (U331) is READ and latched into the History Registers (U845, U841, U743, and U843) and U325 at the rising edge of DCK-0. Immediately following the READ, the output of U325 is enabled by T0-0. Data from U325 is then written into the Delay Memory at the next 16CK-0's rising edge. Address

lines for the Delay Memory are then incremented and data is READ and latched from the new location at the next DCK-0. Thus memory READ always occurs before memory WRITE and image data will not appear in the History Registers until the address has been stepped to top of memory and reloaded with the offset value held in U343. Figure 3-34 shows the timing requirements.

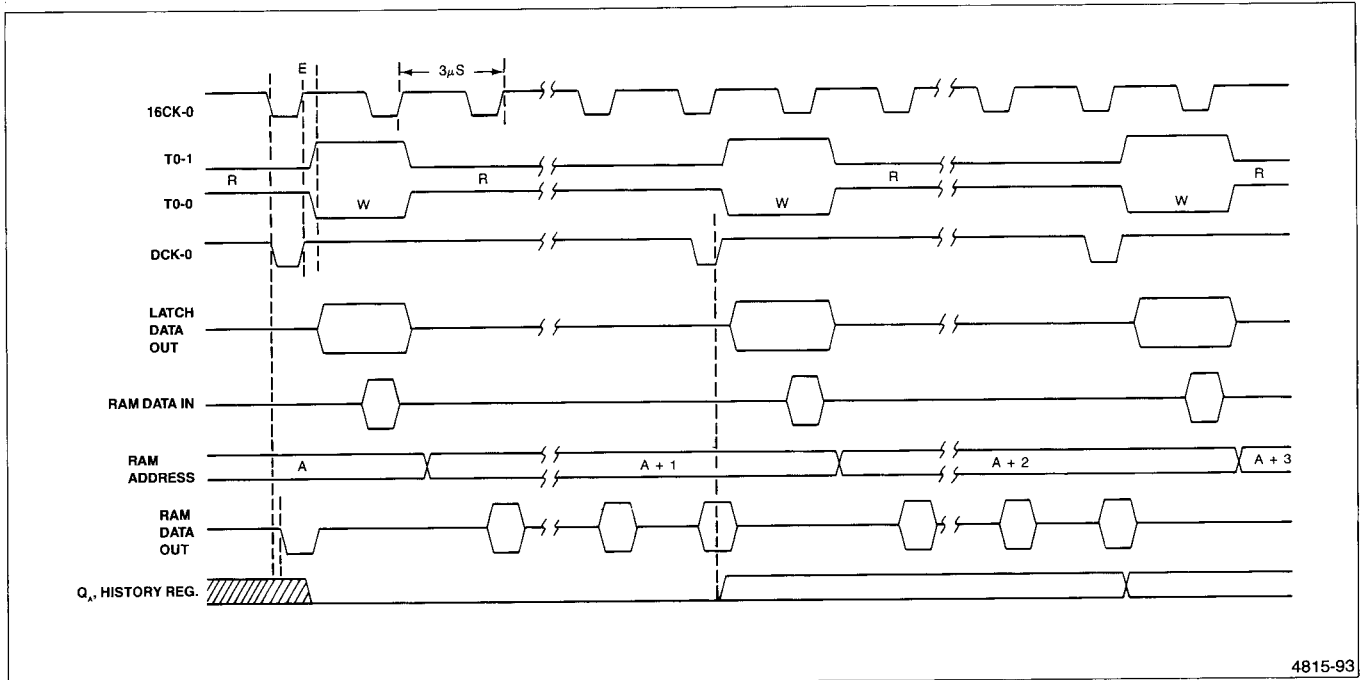


Figure 3-34. Spatial Normalization Timing.

Example: Offset data to U343 is set at 125 (decimal). 2's Complement $[125] = (2^7 - 125) = (128 - 125) = 3$. The total delay is 3 pixels. The Delay Memory (U331) is cleared prior to data appearing on the output of the nibble selector U421. The following string represents data out of the nibble selector for Magenta, at DCK-0 intervals.

From Nibble Selector: M1, M2, M3, M4, M5, M6 — see Table 3-10.

Table 3-10
DELAY SEQUENCE EXAMPLE

Address	Data Read	Contents Read, @DCK-0	Contents Write, @ (T0-0).(16CK-0)
A	O	O	M1
A+1		O	O
A+2		O	O
A		M1	M1
A+1	O	O	M2
A+2		O	O
A		M1	M1
A+1		M2	M2
A+2	O	O	M3
Load Offset Address To "A"			
A	M1	M1	M4
A+1		M2	M2
A+2		M3	M3
A		M4	M4
A+1	M2	M2	M5
A+2		M3	M3
A		M4	M5
A+1		M5	M5
A+2	M3	M3	M6

To History Register: O, O, O, M1, M2, M3. . .
3 Pixel
Delay

PATTERN COMPENSATION

The Pattern Compensation circuitry attempts to compensate for ink-jet head printing anomalies that occur in response to past and future ink-jet head activity. Compensation is accomplished by modulating the drive voltage to a specific ink-jet head. Pixel data for each primary is shifted serially into a "History Register" (U845, U841, U743, and U843). The data from the History Register addresses (A0 – A6) the Pattern Compensation ROM. A3 is decoded by the Pattern Compensation ROM as current pixel data. A0-A2 are decoded as future data and A4-A6 as past data.

The Pattern Compensation ROM contains 16 possible data planes. (compensation can be different for each of the 16 possibilities.) A plane for each primary (Yellow, Magenta, Cyan, and Black) and for each primary four possible pixel resolutions (128, 138, 148, 158, DPI). The resolution plane is selected by the Processor as specified by the host with bits A9 and A10 — see Table 3-11.

Table 3-11
PATTERN COMPENSATION ROM CONTROL

Resolution			Color Plane Select		
A10 (Pin 19)	A9 (Pin 22)	Dots Per inch (DPI)	A8 (Pin 23)	A7 (Pin 1)	Color
0	0	128	0	0	Yellow
0	1	138	0	1	Magenta
1	0	148	1	0	Black
1	1	158	1	1	Cyan

THEORY OF OPERATION

The states of A8 and A7 are controlled by the Waveform Generator Timing Decoder circuitry. A color specific History Register is selected to present data to the Pattern Compensation ROM. A8 and A7 are controlled such that the specific color's compensation is output from the Pattern Compensation ROM to the Pattern Compensation Data Formatter. Here, successive RCK-0s direct the data to the respective register as shown in the Pattern Compensation Data Formatter State table. At T0-0 data from the Formatter is latched by each color specific D/A converter. The value latched by a D/A converter determines the amplitude of the drive signal to a particular ink-jet head. The D/A converters

also serve as gating for the drive signal to an ink-jet head. If bit A3 is zero, then the output of the Pattern Compensation ROM is all zeros and the amplitude at the output of the D/A converter is also "zero." If A3 is a one then the output of the Pattern Compensation ROM is some non-zero value dependent on past and future ink-jet head activity. This will result in a head drive voltage from 155 to 225 volts pk/pk. The voltage adjustment (R705, R801, R803, and R805) range for cyan, yellow and magenta is nominally from 175 to 214 volts. The black head drive adjusts from 200 to 244 volts. Refer to Figure 3-35 and Table 3-12.

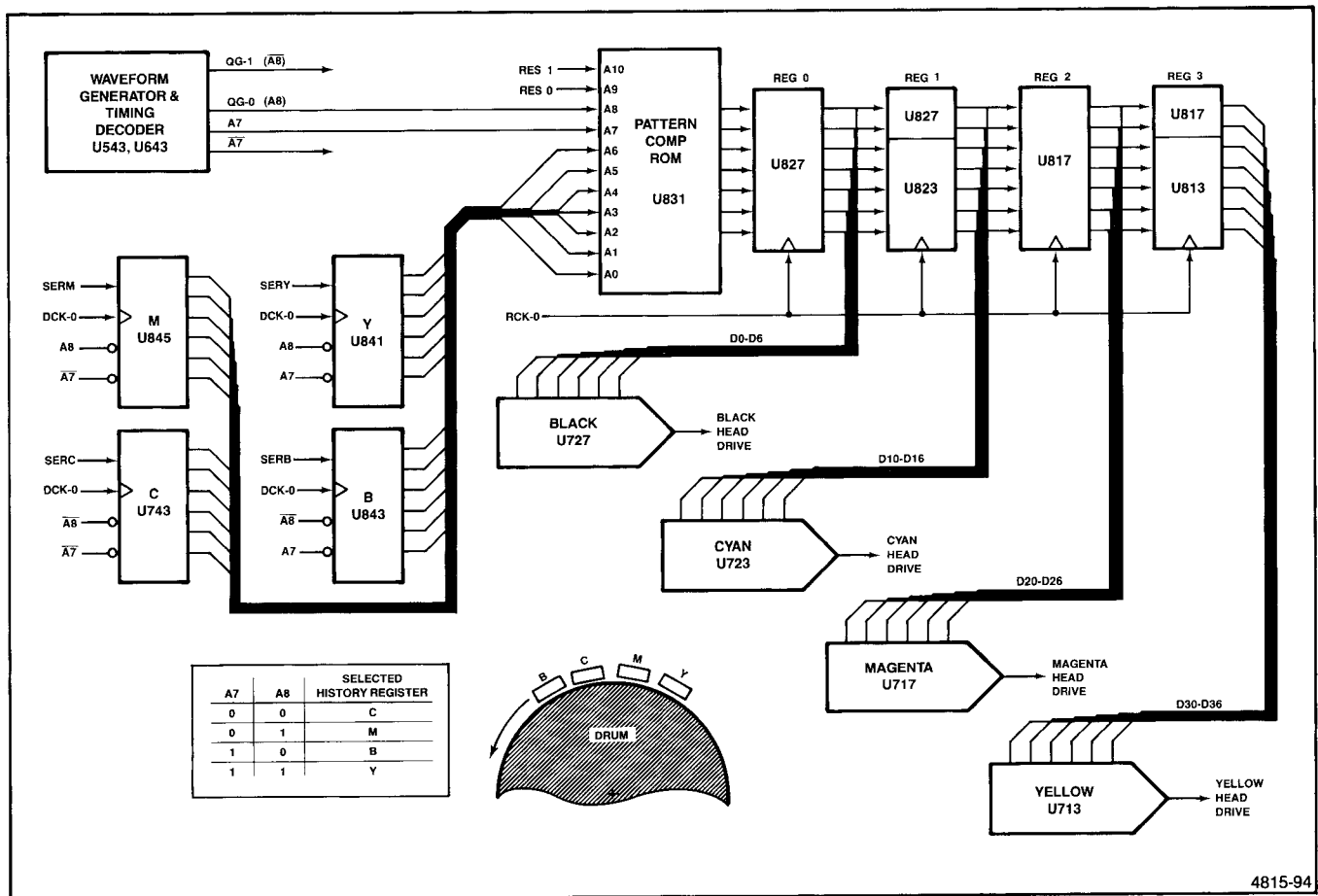


Figure 3-35. Block Diagram of Pattern Compensation Circuitry.

Table 3-12
PATTERN COMPENSATION DATA FORMATTER
(STATE TABLE)

STATE	Data Flow			
	Black U727	Cyan U723	Magenta U717	Yellow U713
Clear	0	0	0	0
1st RCK	YEL	0	0	0
2nd RCK	MAG	YEL	0	0
3rd RCK	CYN	MAG	YEL	0
4th RCK	BLK	CYN	MAG	YEL

INTERFACE PROCESSOR TO PRINT ENGINE COMMUNICATION

To ensure properly timed data transfer, the two Processor sub-systems must maintain communication. The serial ports of the 6803 Processor (U611) on the Parallel Interface board, and the 6803 Processor (U121) on the Process Control board provide the required link. The serial data link (TXD-1 and RXD-1) "handshakes" the image data from one Processor sub-system to the other. TXD-1 informs the Process Control that a data pixel has been placed on the bus. RXD-1 informs the Parallel Interface Processor Kernel that the word has been received — see Figure 3-36.

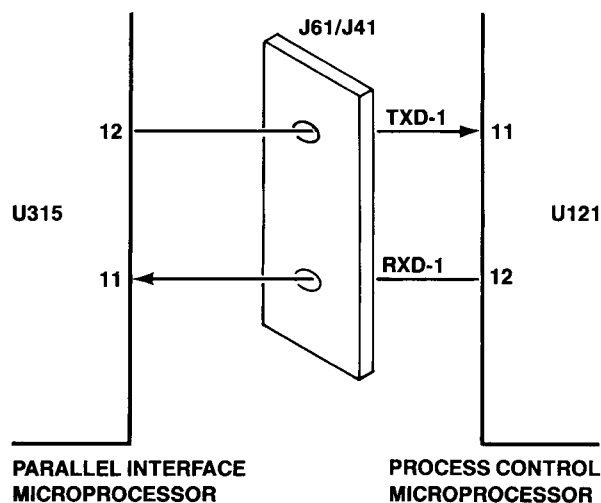
INTERLOCK SWITCHES

The copier has three interlock switches. Copier operation halts whenever one of these switches is opened.

If the copier power-up routine finds the head carriage out of the HOME position (the head-cap position), a FAULT is indicated. The CLEAR button resets the FAULT condition provided the power-up routine was able to return the head carriage to HOME.

The top cover must be closed for the copy process to begin. The optical DOOR switch tells the Processor when the door isn't properly closed, and inhibits the copier until the operator closes it, and clears the FAULT.

The third switch is the VACUUM switch. The copier must maintain the vacuum/air systems for movement of the media from the input tray, onto the drum, and into the exit tray when the copy cycle is completed. If the VACUUM switch indicates low or no vacuum, the copier processes will be inhibited and a FAULT indicated.



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Figure 3-36. Inter-Processor Communication Link.

FRONT PANEL

The front panel provides a number of user inputs and Processor outputs. The Operator's manual details users information. The Processor uses the front panel to display error codes whenever a FAULT occurs. A FAULT may indicate the copier is out of paper, ink is low or out, maintenance fluid is out, or a data transmission error occurred. The operator's manual provides detailed explanations of the front panel.

The service value of the front panel is the display of error codes. If a fault occurs, the FAULT lamp lights and the other front panel indicators display a coded error message. Appendix J *Error Codes* provides a chart listing the error codes and their interpretations. Figure 3-37 shows a block diagram of the front panel and its interface with the Process Control Processor.

Indicators and Inputs

A critical component of the copier's self-diagnostics is the Fluid Level Detection circuitry. This circuitry allows the Processor to determine whether an ink cartridge is low or out, the waste chamber of the maintenance fluid cartridge is full, or the wash chamber of the maintenance fluid cartridge is empty. Status of the fluid system is reported to the user via the front panel. The circuitry indicates a fault condition before there is any chance ink-jet head performance being affected.

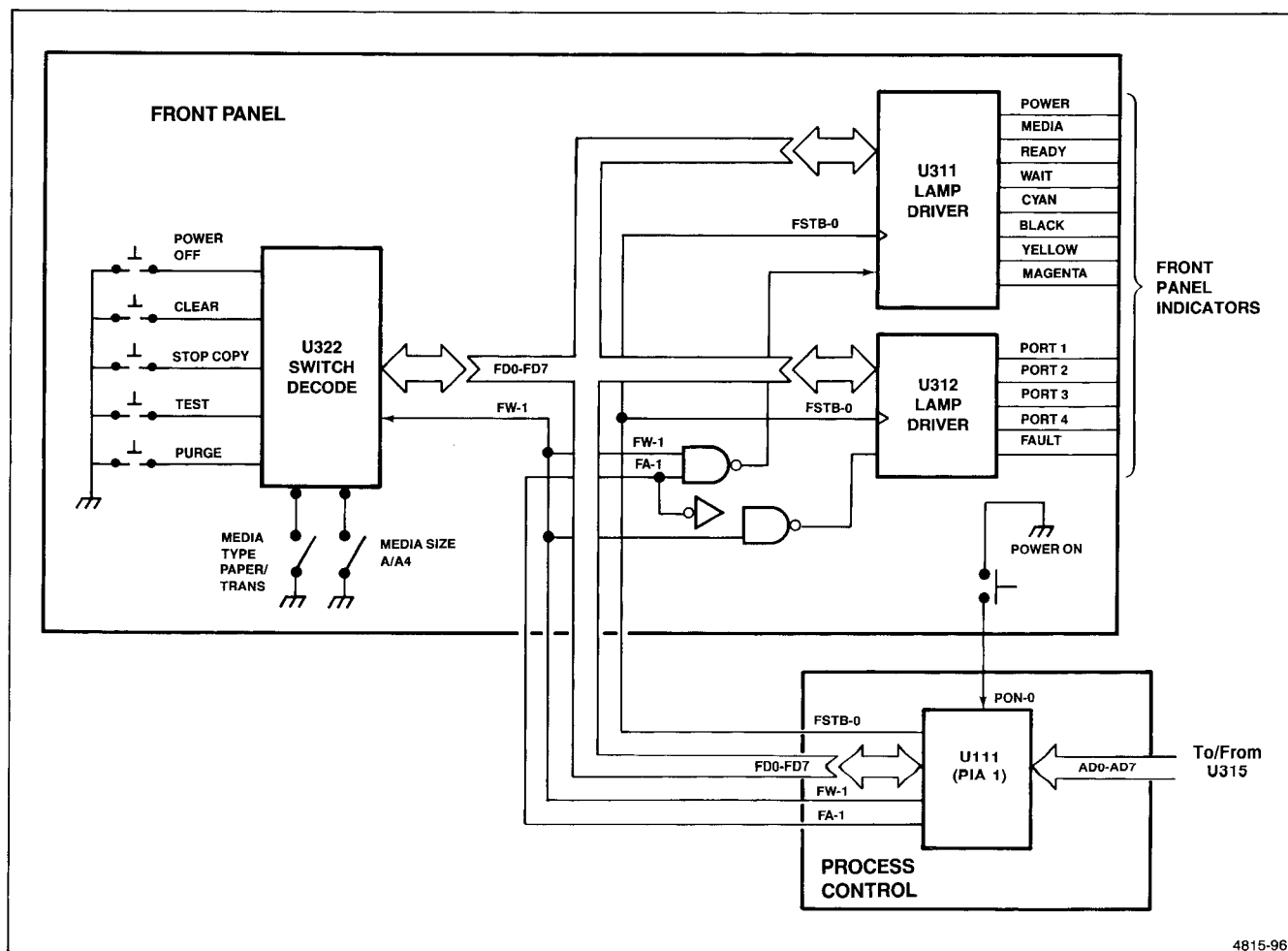


Figure 3-37. Front Panel Block Diagram.

Communication with Interface Processor Kernel

The Processor on the Process Control board controls the read and write functions to the front panel. A bidirectional data bus (FD7-FD0) is the communication link between the front panel and U111 (PIA#1) on the Process Control. U111 generates a one microsecond strobe (FSTB-0) immediately following a WRITE instruction to the "B" data register. The front panel uses the strobe to clock data into the selected register. If FW-1 = 1, either U311 or U312 latches data onto the bus. FA-1 = 1 selects U311, and FA-1 = 0 selects U312. When W-1 = 0, the Processor reads data from U322.

Fluid Level Detection

The Front Panel fluid level indicators are the visual outputs of a multiplexed sample and hold network which responds to the conductivity of each ink cartridge and the maintenance fluid cartridge. The Front Panel has one indicator for each cartridge and the MAINTenance indicator for the maintenance fluid cartridge. Figure 3-38 illustrates this circuit.

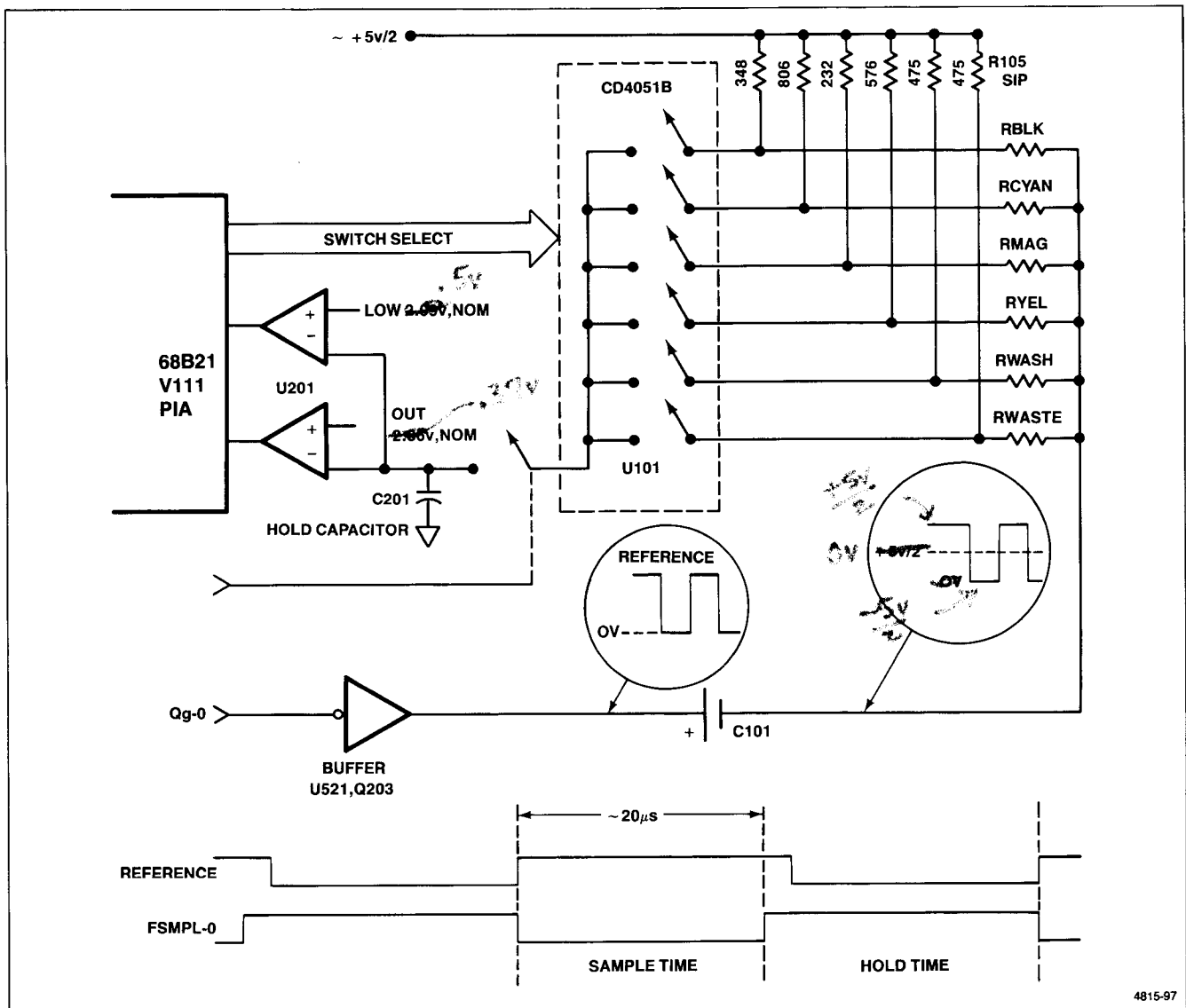


Figure 3-38. Fluid Detection Circuit.

Circuit Description

All fluid cartridges are equipped with a pair of sensing electrodes. While one of the electrodes injects a 20.83KHz (5Vp/p) signal into the fluid, the other electrode samples the detectable amplitude and compares it to a predetermined level to indicate an INK LOW or INK OUT condition. The ac reference signal is applied to avoid polarizing any of the fluids (polarization can yield erroneous measurements as well as cause the fluids to undergo electrolysis). The other probe contact is grounded through a value in resistor pak R105. A particular fluid impedance is sampled when FSMPL-0 is low. A voltage proportional to the fluid impedance is stored in C201 and compared with preset levels for INK LOW and INK OUT conditions. As the fluid level in a cartridge decreases, the impedance between the probe contacts increases causing the sampled voltage to decrease. Front panel indication for the maintenance fluid cartridges is either full or empty. The output of this comparator is readable by the Processor, and the channel select of U101 is writable by the Processor — see Table 3-13. The Process Control memory map indicates the channel assignments.

Table 3-13
FLUID DETECTION

A	B	C	Cartridge Checked
(Pin 11)	(Pin 10)	(Pin 9)	
0	0	0	BLACK
0	0	1	CYAN
0	1	0	MAGENTA
0	1	1	YELLOW
1	0	0	WASH
1	0	1	WASTE
1	1	0	GROUND
1	1	1	GROUND

R105 contains resistors selected such that ink out is indicated when 30 to 60ml of ink is left. Ink low is indicated 5-10ml above the ink out condition. This allows 50 to 100 copies to be made under a condition of low ink prior to the fault condition of ink out.

Nominal impedance trip points for INK OUT are:

BLACK— 1773 ohms
MAGENTA— 1190 ohms
YELLOW— 2940 ohms
CYAN— 4107 ohms

PROCESS CONTROL TO DRIVE MODULE CONTROL SIGNALS

The Processor (U121) receives instructions from U311 (PROM). U241 (FPLA) decodes address lines to provide control signals to the various subsystems within the copier. The output signal from these chips control and monitor the electro-mechanical drive circuits found on the Drive Module. The E-0 and 16CK-0 signals provide the major timing signals which synchronize the Drive Module processes with the data information output to the ink-jet heads. The major interconnect signals between the Process control and the Drive Module are:

- E0: a 1MHz clock to the Drum PLL Servo Drive, and Blower PLL Servo Drive.
- BD7-BD0: address/data bus to the Drum PLL Servo Drive, Blower PLL Servo Drive, and U355 output.
- DEN-1: Drum amplifier and Drum Hall Switch feedback enable.
- WIOF-0: Write strobe to the Blower PII Servo Drive for diagnostics.
- WIOD-0: Write strobe to the output port (U355).
- WIOC-0: Write strobe to Drum PII Servo Drive.
- RIOD-0: Read select for U455.
- RIOC-0: Read select to Drum PII Servo Drive logic.
- 16CK-0: 16 × Dot Clock to Carriage PLL Servo Drive.
- YRATE-0: scaled 16CK to carriage drive counters, Y-axis reference during imaging, and velocity profiling during carriage positioning.
- BID-0: Blower increment/decrement. Enables the Blower Servo Velocity Error accumulator to count up/down in response to errors detected in the phase/frequency discriminator.
- BINC-1: Blower increment. When asserted with BID-0, causes the error accumulator to count up.
- STRIP-1: Logic enable for the stripper solenoid.
- BLACK: Ink-jet drive sinewave with V = 2.2v pk/pk (nominal), and the period is 48uS.
- CYAN: Ink-jet drive sinewave with V = 1.9v pk/pk (nominal), and the period is 48uS.
- MAGENTA: Ink-jet drive sinewave with V = 1.9v pk/pk (nominal), and the period is 48uS.
- YELLOW: Ink-jet drive sinewave with V = 1.9v pk/pk (nominal), and the period is 48uS.

DRIVE MODULE

INTRODUCTION

The Drive Module circuit board is attached to the Process Control circuit board by a captive connector. It carries the instructions issued by the Process Control to the copier's electro-mechanical drive circuits on the Drive Module.

OVERVIEW

The Drive Module consists of the following functional blocks:

- **PWM (PULSE WIDTH MODULATOR) POWER CONVERTER** — provides the regulated low voltage supplies to the copier.
- **CARRIAGE μ STEP MOTOR DRIVE** — controls the direction, speed, and location of the head carriage.
- **BLOWER PLL (PHASE LOCK LOOP) SERVO DRIVE** — controls the blower velocity. The blower provides air for the paper fluffer and vacuum for picking the paper. The Blower motor drives the air pump.
- **DRUM PLL (PHASE LOCK LOOP) SERVO DRIVE** — controls the direction and velocity of the drum.
- **INK-JET DRIVE AMPLIFIERS** — provide the voltage and current to excite the piezo-electric crystals in ink-jet heads.
- **SOLENOID/PUMP DRIVES** — activates the stripper, fluffer, air valve solenoids, and the wash pump motor.
- **OPTIONAL SOLENOID DRIVE** — allows connection of the optional copy counter solenoid.

PWM POWER CONVERTER

This section of the Drive Module contains the following low voltage power supplies:

- + 28 volt unregulated dc
- + 12 volts dc
- -12 volts dc
- -6 volts dc
- + 5 volts dc
- + 5SW volts dc

Line Voltage Input Selection

The input from the power cord is applied to the line filter connector on the rear panel of the copier. The line filter module contains a selectable cam switch providing easy selection of for various line voltages.

The output of the chassis mounted transformer connects to the bridge rectifier mounted on the back panel. The rectifier and associated filter capacitor provides a + 28 volt dc supply that is active whenever the copier is connected to the power line.

CAUTION

The + 28 volt rectifier on the rear panel is active whenever the power cord is connected to the power line. Use caution whenever working in this area.

The output of the bridge rectifier (mounted on the back panel) connects to J9 on the Drive Module which contains the circuitry for the low voltage power supply.

PWM (Pulse Width Modulator) Power Converter

U651 provides a fixed +5 volt reference and PWM outputs to drive Q865 which drives Q861. Q861 sends current to coil taps 4 and 5 of T861. The coil between 1 and 2 of T861 provides a bias voltage for predriver Q865. The duty cycle of Q861 is controlled by U651 to deliver the right amount of current to C757 to maintain the +5 volt supply. By switching current through taps 4 and 5, an ac voltage is induced on the +12 volt coils 8, 9, and 10. The regulation of the +5 volts supply is sufficient to regulate the +12 outputs without any need for post rectification regulation. In addition, taps 7 and 6 provide a +2 volt bias above the +28v supply for use in biasing pre-drivers Q271, Q281, and Q291 in the Blower Drive Circuit.

The "dead time" input (U654 pin 4) is used to turn the low voltage switching supply on and off. When PON-0 asserts (either by the front panel, the Processor, or the test strap) the power supply is enabled. If PON-0 is not asserted, the "dead time" input is pulled up to the +5 volt reference (pin 14). This keeps the supply off (infinite "dead time").

Current limiting for the supply is accomplished with bias resistors R661, R663, R665, R667, current sense resistor 751, and the internal error amplifier connected to pins 15 and 16 of U651. If the voltage drop across R751 exceeds 130mV (equivalent to 5.2 amps drawn from the +5 volt supply), the error signal created causes U651 to "fold back" the supply. During fold back, the switching duty cycle is very low, resulting in about 2 amps of current available to the load. The supply will resume normal operation when the load on the supply is reduced to less than 5.2 amps.

U651 contains an internal saw-tooth oscillator used to control the switching frequency and duty cycle of the supply. The oscillator frequency is set by R657 and C655. Q651 is used as a source follower to buffer the local oscillator. The output of the Q651 is an +2.4v pk/pk 40 kHz saw-tooth signal. This buffered output is used for the blower and drum PWM circuits.

Power Supply Protection

The crowbar circuit consisting of VR857, R855, and Q855 protects the +5 volt supply from over-voltage. C757 provides storage capacity to maintain the regulated +5 volt supply under varying load conditions. If the voltage on the plus side of C757 exceeds +6.2 to 6.7 volts, the current through VR857 develops the voltage across R855 necessary to turn on the SCR (Q855). If Q855 turns on, it pulls the +5 volt supply to ground to protect the copier circuitry from over-voltage. If Q855 "crowbars" (turns on), power must be cycled, by removing and reinstalling the ac power cord, to disable Q855.

For additional protection, the following supplies are fused:

Table 3-14
POWER SUPPLY FUSES

Power Supply	Fuse	Value	Circuit
+28 volt	F661	2A-fb	x
-12 volt	F851	.25A-fb	x
+12 volt	F855	.25A-fb	x
1 +28 volt	F271	8A-fb	Blower
2 +28 volt	F571	8A-fb	Drum
3 +28 volt	F761	2A-fb	Ink-jets

Electro-Mechanical Component Protection. The circuits operating and controlling the electro-mechanical components (drum, blower, ink-jet amplifiers, and solenoids) must be under Processor control at all times. To ensure this, all component pre-drivers are inhibited by holding +5SW off upon power-up. In addition, the Processor monitors power supply integrity via the signals PFAIL-1 (Power Fail) and RESET-0. The ink-jet drive power amplifiers are also inhibited during power-up via IJBias to protect the ink-jet heads.

+5SW Volt Supply. Upon power-up, the +5SW volt supply is held off until the +5v supply is greater than +4.8 volts and the +12v and -12v supplies are greater than +9v and -9v. The voltage dividers of U681D set the +9v switching level when +5v supply is greater than 4.8 volts. The +5v supply is monitored by the voltage divider consisting of R693 and R692. When the voltage at pin 14 of U681 exceeds 2.5v, U591 is enabled, turning on Q595.

The +5SW volt supply provides power to the logic gates that are used as "pre-drivers." A pre-driver is defined as the last logic gate before the analog drive circuits. They include the following logic chips on the Drive Module:

- U381A– Blower PLL Servo Drive
- U373(A & B), U377(A & B), U383(A & B)– Drum PLL Servo Drive
- U371A, U581(A & B), & U585A– stripper, fluffer, air valve solenoids, and wash pump drivers.
- U371B & U585B– Optional solenoid drivers.

IJBias. The ink-jet power amplifiers are U871, U881, U886, and U891. These drivers must not be allowed to output any signal to the ink-jet heads until the power supplies are stable and the Processor is in control. The reference voltage on pin 1 of these drivers is IJBias which remains below ground and keeps the drivers off until the supplies are stable. This prevents harmful voltage transitions from activating the ink-jet heads during power-up. VR796 is a +10 volt zener diode that maintains a constant bias at pin 1 of the drivers during normal operation. The zener diode decouples this bias from +12v variations.

PFAIL. PFAIL-1 (power fail) is asserted if the internal +28v supply drops below +21 volts due to low line voltage or internal circuit problems. PFAIL-1 is deasserted if the +28v then recovers to +22.5v or greater. If PFAIL occurs the Processor will engage the stripper solenoid and then attempt to reset the copier if the +28v recovers. The Processor will then indicate a FAULT on the front panel. If the CLEAR is then depressed, the Processor will attempt to restore the copier to "ready" status.

RESET. RESET-0 is asserted until the +5SW volt supply is stable. RESET-0 resets the copier hardware and, after deasserting, vectors the Processor to the power-up routine.

CARRIAGE MICRO-STEP MOTOR DRIVE

This circuit controls the direction and velocity of the head carriage assembly. The head carriage must be able to travel in both directions at a speed determined and controlled by the Process Control Processor. The microstep concept allows the carriage drive circuitry to address the position of the carriage drive stepper motor in increments much smaller than the size of an image pixel. This allows the ink-jet head to be precisely located without loss of image resolution due to head carriage movement.

Soft Power-up

On initial power-up, the carriage motor and ink-jet heads are protected from the possibility of a physical jolt. This control is established by a "soft power-up" circuit consisting of C157, R361, R551, and Q167. This circuit applies power to R161, the resistor ladder, which is used to control the carriage microstep motor drive.

The logic signal CEN-1 (carriage enable) is used to initiate a "soft power up." U355 is the output control port for the function.

Carriage Drive Control

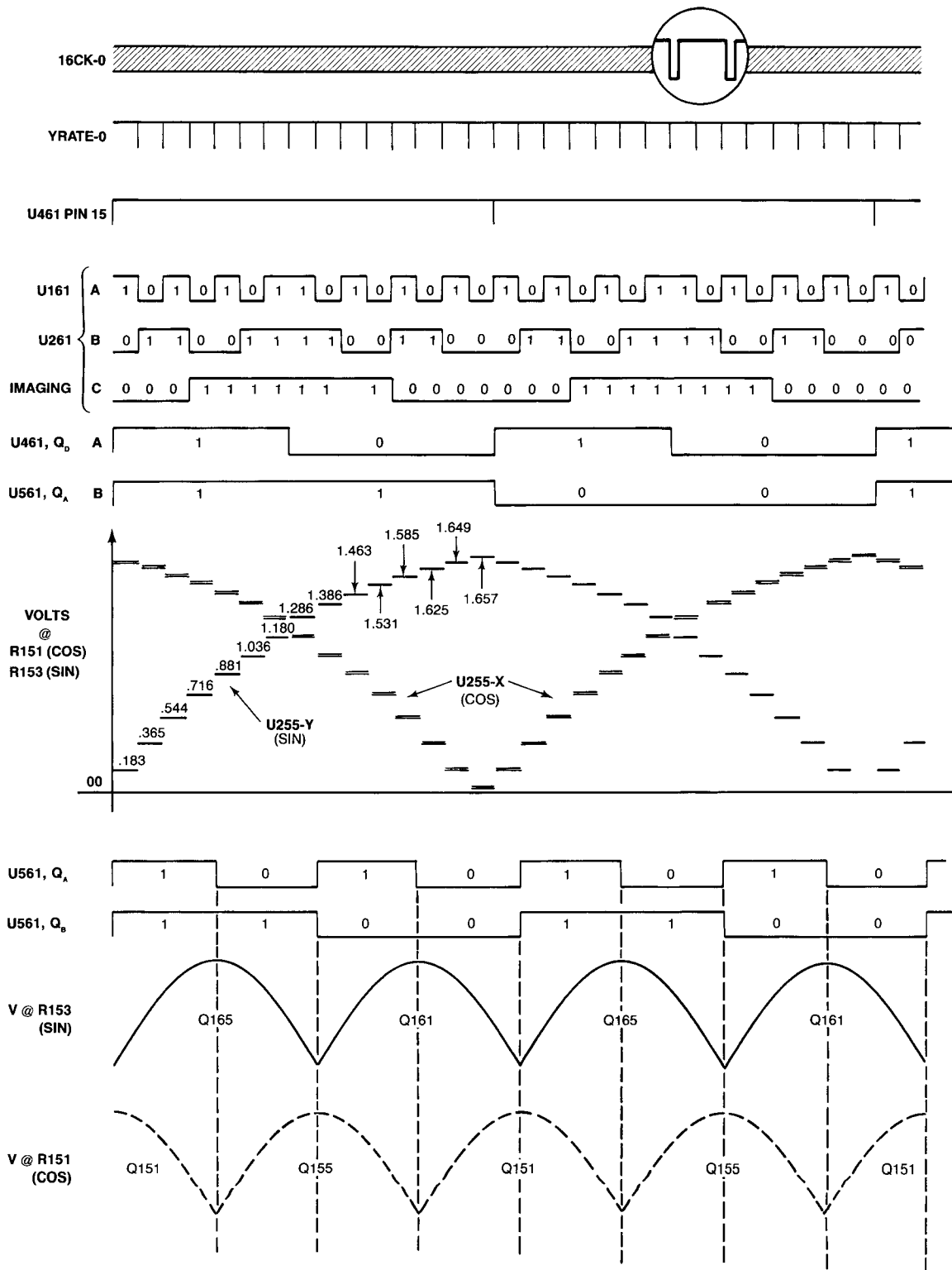
The carriage movement is controlled by three signals. They are:

- 16CK: 16 times the system dot clock rate.
- YRATE-0: the frequency of YRATE-0 is determined by the System Timing Controller (U131 on the Process Control board). This signal controls the speed of the carriage and is synchronized with 16CK and the image data.
- YMIN-1: (Y-minus) This signal controls the direction of the carriage movement by controlling whether U461 and U561 are counting up or down. The counters count down during imaging and up to index the carriage.

U461 counts YRATE-0 pulses synchronously with 16CK-0. The outputs of U461 drive exclusive-or gates U265. The QD output of U461 controls the polarity of the A, B, and C inputs of U261. When QD equals 1, the ex-or outputs are the inverse the input. When QD equals 0, they are non-inverting. Thus, as U461 and U561 count down (imaging mode), the voltage at the "Y" output of U255 increases in a sinusoidal manner as shown in Figure 3-39. At the same time, the "X" output of U255 decreases in a sinusoidal manner. The inputs to U255 are configured to piece together one quadrant of a sinewave (generated with R161) to make half sines-waves which are 90 degrees out of phase of each other. The outputs of U255 are buffered by U151 and sent to U250, a multiplexer, controlling when each phase of the stepper motor is driven with the half sines-waves. Figure 3-39 shows these timing relationships.

BLOWER PLL SERVO DRIVE

The Blower PLL Servo Drive scales the velocity of the Blower using the vacuum switch as pressure feedback. This ensures that the proper media pick vacuum will be achieved as instrument ambient air pressure varies from site to site. This scaling also allows the Processor to detect media load or ejection faults. Under normal operation the Processor determines what blower velocity is necessary to pick the media and sets the TC3 output of the 9513 (U131 Process Control) accordingly. The rate at TC3 is compared with the actual blower velocity BVEL-1 with U431, Process Control. The resultant error term BID-0, and BINC-1 control counter U551 which sets the proper current to maintain the desired blower velocity. The output of U671 is an analog voltage representing the digital value of the outputs of U551. This voltage is applied to R685, R684, and R683 which set the gain (1 volt at pin 1 of U671 yields 1.5A of Blower current) of the loop and CR786, CR785 which act as current limiters by limiting the voltage excursion to U571. U571 creates a pulse width modulated control signal for the predrivers U381, U375. This is accomplished by comparing the voltage at current sense resistors R181 and R191 to the voltage set at pin 8 of U571. PWM results from the injection of a saw-tooth oscillator (40 kHz, 50mV pk/pk) riding on the voltage representation of Blower current at pin 9 of U571. The comparator, U571 adjusts the duty cycle of its output to maintain the current value set by U551. The current value of U551 is adjusted to maintain the Blower velocity dictated by the Processor. FPLA U387 decodes the Blower Motor Hall sensor states which sense motor angular position and velocity. The output of U387 commutates the 3-phase Blower motor. U551 can also be set open loop for testing via the Processor data bus lines BD0-BD3.



4815-98

Figure 3-39. Carriage Drive Timing.

DRUM PLL (PHASE LOCKED LOOP) SERVO DRIVE

The Drum PLL Servo Drive uses Hall sensor position information to commutate the drum motor and control its speed and direction of rotation. It operates in two modes, open loop and closed loop. Open loop is used for indexing the drum position prior to media load. Closed loop is used to control the drum velocity during media wrap up, imaging and media strip.

Open Loop Mode

During open loop actuation, \overline{Q} (pin 8) of U555 is set high which turns off Q779, eliminating the lead compensation network used only in closed loop mode. In open loop mode, the drum motor is positioned by varying the current to it via U451 and U671 which make up a digital to analog converter.

The D/A converter uses QD of U451 to control the direction of drum rotation and Q's A, B, C to vary the magnitude of the current. If QD equals 0, the drum rotates in the direction of indexing. If QD equals 1, drum rotation will be in the imaging direction. Maximum current in the indexing direction occurs when the outputs of U451 are all zero. Maximum current in the imaging direction occurs when the outputs of U451 are all one.

The voltage at the output of U671 pin 7 is applied to R782 and R681. CR782 and CR787 act as current limiters by limiting the voltage excursion at R681 and thus the current through R681 to the summing node at pin 10 of U571. U571 adjusts the duty cycle of the drum drive as it tries to maintain VB (+ 2.5v) at pins 11, 10 of U571. R395 and C393 provide a delay to allow coil commutation data to propagate through the FPLA U361 before turning on the drive.

The voltage at pin 14 of U671 represents the sensed current through the motor. The duty cycle out of pin 13, U571 is adjusted until the voltage at pin 14 U671 supplies sufficient current through R584 to null out the current supplied through R681. A sawtooth oscillator signal (40kHz) is injected at the summing node through C584. The actual ac offset of the sawtooth with reference to VB pin 11 of U571 determines the duty cycle of the output of U571 pin 13 and, hence, duty cycle of the drum drive.

The drum current is sensed by monitoring the current through each phase of the motor. There are three current sense resistors — R479, R489, and R499. The voltages on these resistors vary as the motor is commutated. U771, using Hall sensor feedback, is also commutated to sense these voltages at the proper time. The result at pin 8 of U671 is the total current driving the drum at any time. If the desired drum current is 2A, the output of U671 pin 7 will be 0.5v. The duty cycle of the drum drive is then adjusted to yield 0.5v at the output of U671 pin 14. This results in 0.6v at the sense resistors or 2A through the drum.

Closed Loop Mode

In closed loop mode, the Processor sets a reference velocity (DREF-1) with the 9513 TC4, (U131 Process Control). The current to the drum is adjusted through U451 to maintain this velocity. The actual drum velocity is acquired by differentiating each hall sensor transition. This is accomplished by delaying the Hall sensor outputs by 2 E-0 clocks with U257 and qualifying these terms (in the FPLA, U361) with Hall sensor outputs delayed by only one E-0 clock. U257 also enables and disables the drum drive by interrupting Hall state position feedback when U257 is cleared. This causes FPLA U361 to inhibit the drum drive.

The drum motor has six unique coil (Hall) states for each 180 degrees of mechanical rotation. Coil commutation information is derived from the Hall switch states using FPLA U361. The differentiation function of the FPLA is sensitive to all Hall switch transitions. It provides a pulse per transition on the DECrement output for CCW (imaging) rotation and a pulse per transition on the INCrement output for CW (indexing) rotation. The INC and DEC outputs represent the sensed velocity of the drum and are used to control the velocity error accumulation in the drum servo.

The drum velocity reference signal DREF-1 is ored (U251) with INC output to increase the drum current by incrementing the velocity error accumulator (U451). An increasing CCW velocity of the drum generates an increasing pulse rate at the DEC output which reduces the content of the velocity error accumulator (U451). When the DEC pulse rate equals the DREF rate, the servo will be in equilibrium — the drum velocity matching the reference rate set by the Processor. Decreasing the DREF frequency decelerates the drum. The drum servo generates negative (retarding) torque as a result of the velocity error accumulator going negative in response to DEC outputs. Hall switch transitions then generate INC/DEC pulses until the velocity error is reduced to its equilibrium value. Refer to Figure 3-40.

The image data path is synchronized via the 9513 with the signal DSYNC-1 derived (U555) from the S1 Hall sensor. To minimize dynamic position error of image scan lines, the drum motor is disabled during the acquisition of DSYNC-1. This minimizes the effects on S1 switching time by magnetic fields generated by the drum motor coils. The drum disable feature is active only during imaging and is generated within FPLA U361.

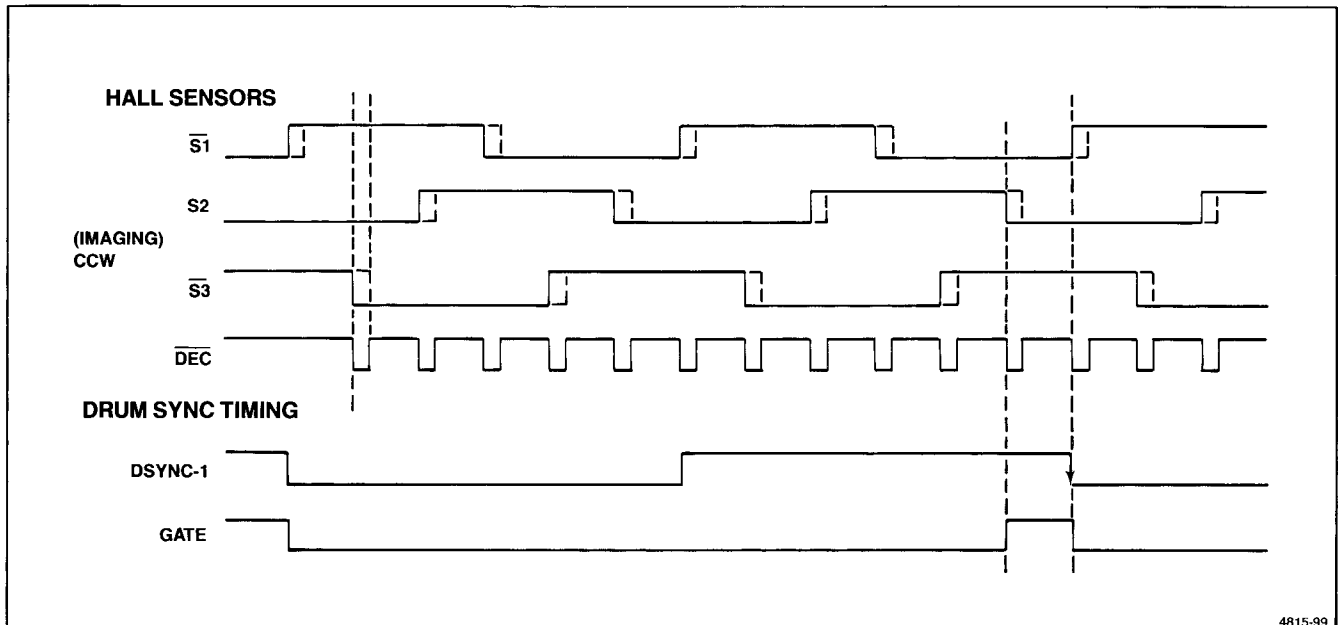


Figure 3-40. Drum Drive and Control Signals.

THEORY OF OPERATION

SOLENOID AND WASH PUMP DRIVES

The stripper, fluffer, air valve, and copy counter solenoids and the wash pump are controlled by the output port U355. The voltage across each device, when enabled, is regulated or not regulated according to need.

The stripper and fluffer solenoids are initially enabled with the unregulated +28v supply applied across them. The stripper for 1.8 seconds and the fluffer for 200ms. This is accomplished using U691 one-shot and part of FPLA U387 used as OR-gates. When the one-shots have timed out, the voltage across the solenoids is pulse width modulated to provide seven volts average across each solenoid. This reduces their power consumption while still maintaining enough energy in the coils for the solenoids to hold their position.

PWM is accomplished with U571. The +5 volts is used as a reference for pin 7 of U571 which resides at +4.92V average. The circuit employs feedback to maintain this +4.92 V average at pin 6 of U571 even with variation in the +28V supply. If the +28 volts changes, the duty cycle (nominal frequency 2 kHz) out of pin 2 of U571 changes to maintain the reference at pin 6 of U571. This same duty cycle is applied to the solenoids to maintain a seven volt average across them — refer to Figure 3-41.

This supply also regulates the voltage to the wash pump. However, when the wash pump is enabled, R586 and CR585 provide a path to ground which increases the regulated PWM output to ten volts.

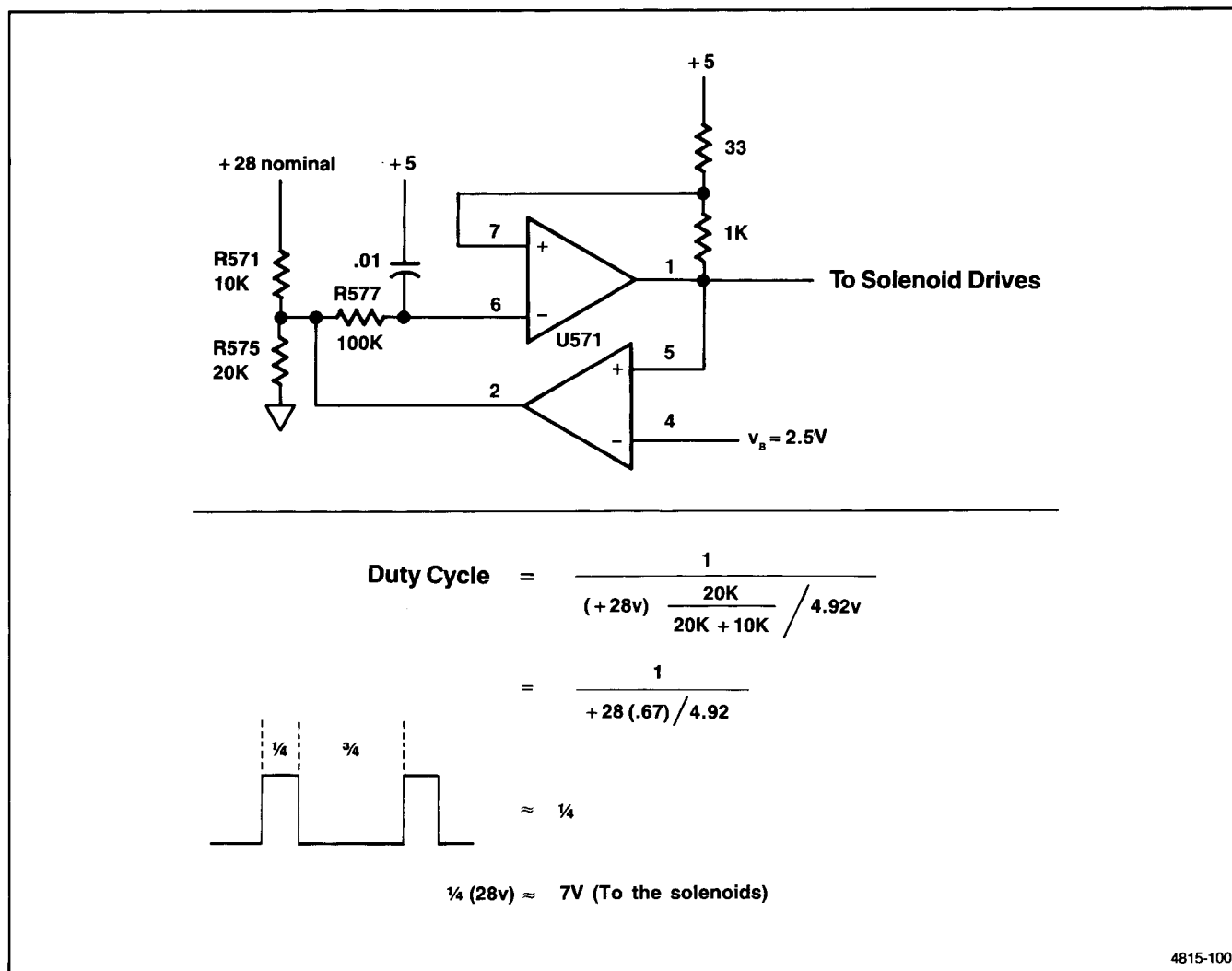


Figure 3-41. Solenoid Duty Cycle Control.

The voltage to the air valve solenoid is regulated by Q393 and VR495 to maintain +3 volts across the solenoid, when enabled under nominal line conditions.

INK-JET DRIVE AMPLIFIERS

The power amplifiers U871, U881, U886, and U891 combine, respectively, with step-up transformers T871, T881, T885, and T891 to drive the ink-jet heads. The gain of the power amplifiers is about 7. The turns ratio on the transformers 360:25. This yields a total gain from the D/A converter outputs on the Process control to the ink-jet heads of $100 \pm 3\%$. Nominal ink-jet head voltage for cyan, magenta and yellow is 190v, and 220v for black. Refer to Figure 3-42.

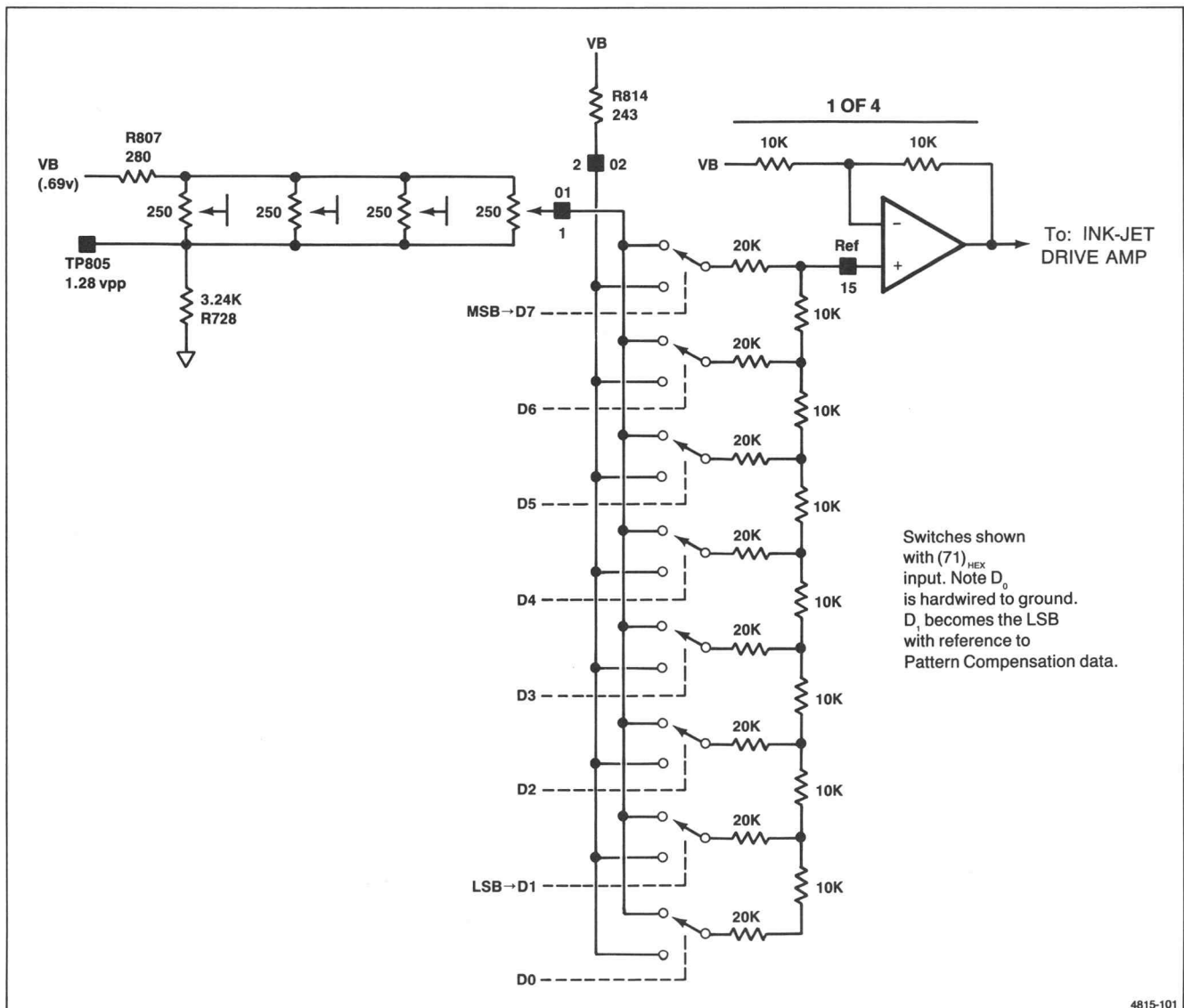


Figure 3-42. Ink-jet Head Drive Circuit.

MECHANICAL SYSTEM THEORY

AIR SUPPLY SYSTEM

The air supply system consists of the air pump, regulator, accumulator and filter (60 micron), ink cartridge air manifold, air valve, and ink-jet head air filter (25 micron) and ink-jet head air manifold.

The ink cartridge air manifold contains a pressure bleed-off hole which serves two purposes:

- During Normal operation, it provides a constant load on the air supply pump. Since the ink-jet heads use very little air, this improves pressure regulation.
- It provides pressure bleed-down when the Purge operation is completed.

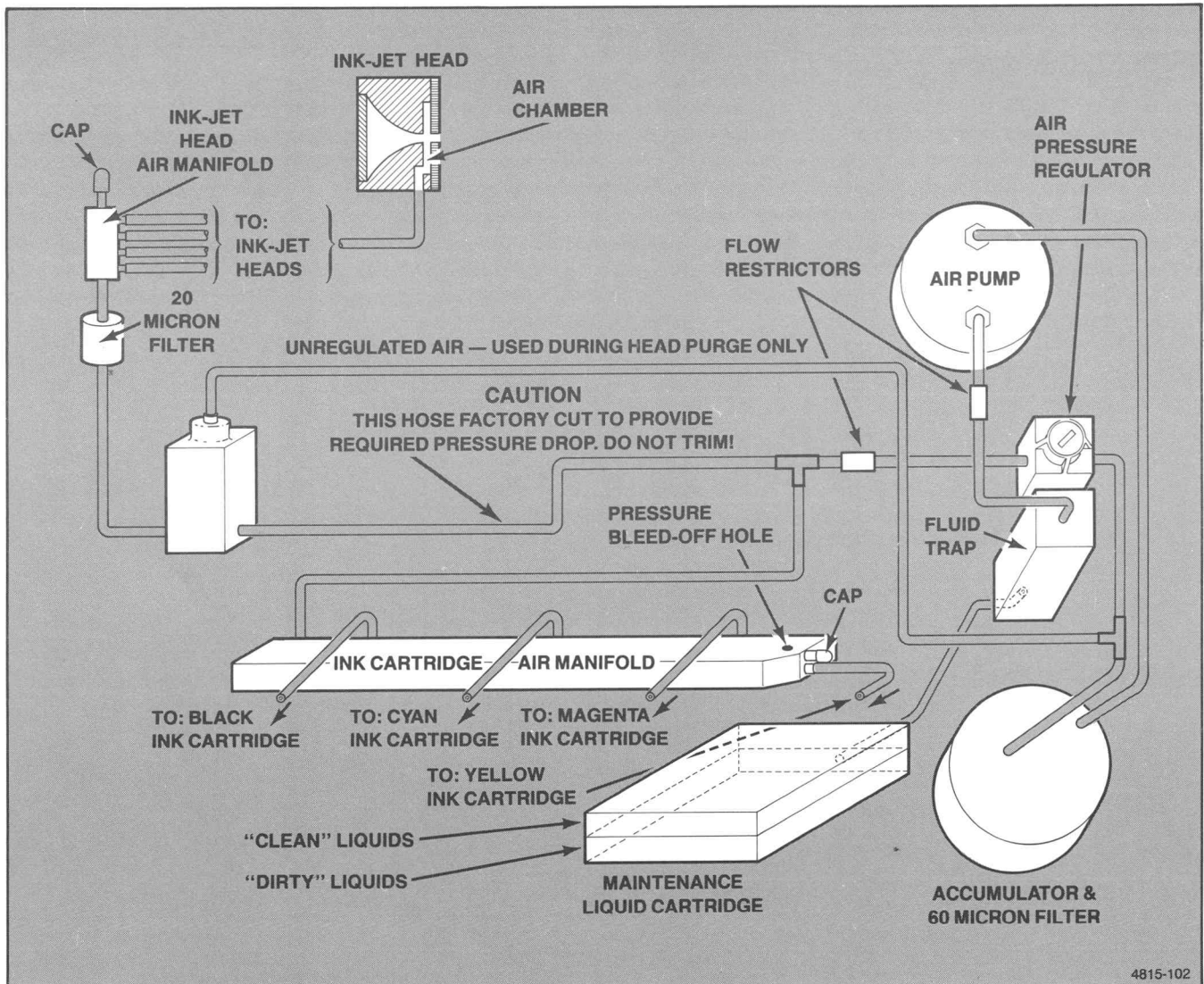


Figure 3-43. Air Supply System.

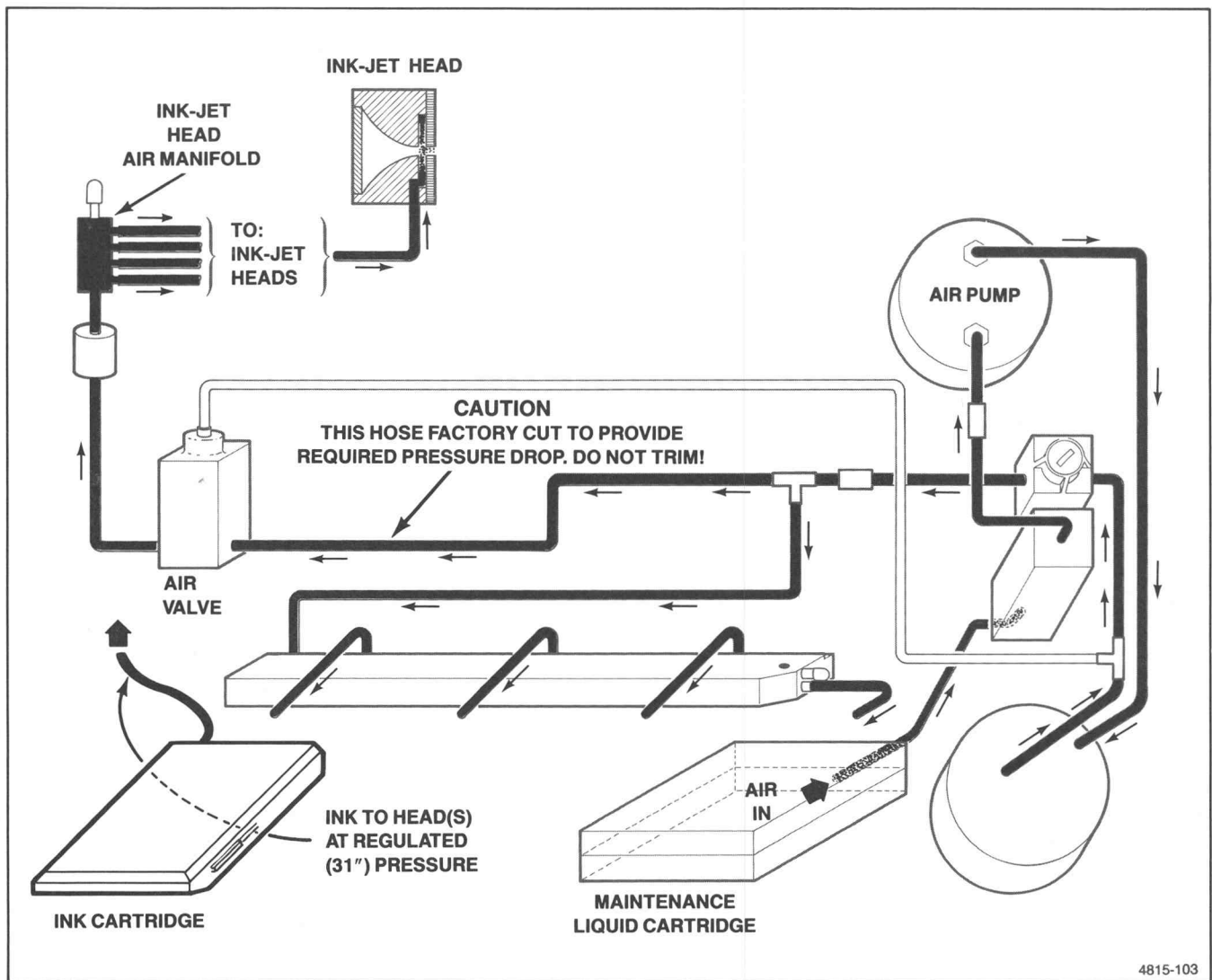
Normal Operation

During normal operation the air pump maintains a positive pressure of 31 inches (of water), and applies it to the ink cartridge manifold and the ink-jet head air manifold. Figure 3-44 shows the air flow through the system during normal operation.

An ink cartridge consists of a plastic shell containing an ink-filled bladder. Air pressure, applied inside the shell, com-

presses the flexible bladder inside and provides pressurized ink to the ink-jet heads.

The air chamber, in the ink-jet head, is nominally maintained at the same pressure as the ink in the ink cartridge. When the copier is in idle mode, an equilibrium exists in the air and ink chambers of the heads. Since the air chamber is between the ink chamber and the media, this equilibrium keeps the heads from drooling ink when not in use.



4815-103

Figure 3-44. Normal Air Flow.

Purge Operation

When a purge cycle is initiated, the air flow through the system is diverted by the air valve solenoid, and a higher than normal pressure (about 80 inches of water) is applied to the ink cartridges. Figure 3-45 shows the redirected air flow during a purge cycle. The purge cycle:

- Removes air pressure from the ink-jet heads by changing the air flow direction through the air valve.
- Changes the air system pressure from the regulated 31 inches of water to an unregulated 80 inches.
- The combination of the two actions listed above causes the air chamber of each ink-jet head to flood with ink.

When the ink-jet head air chambers are flooded, air bubbles or contaminants that may have entered the head are

flushed out and carried to the waste portion of the maintenance liquid cartridge. When the purge cycle completes, the air flow to the system is again directed through the regulator and normal system pressure returns.

HEAD MAINTENANCE SYSTEM

The head maintenance system consist of six main parts. They are the maintenance liquid cartridge, wash pump, head maintenance station, filter, flow restrictor, and check-valve. When the copier is turned on, the copier initiates a wash cycle on the ink-jet heads as part of the initialization routine. A wash cycle is also performed on the ink-jet heads following each purge cycle. Figure 3-46 shows the head maintenance system and its connections.

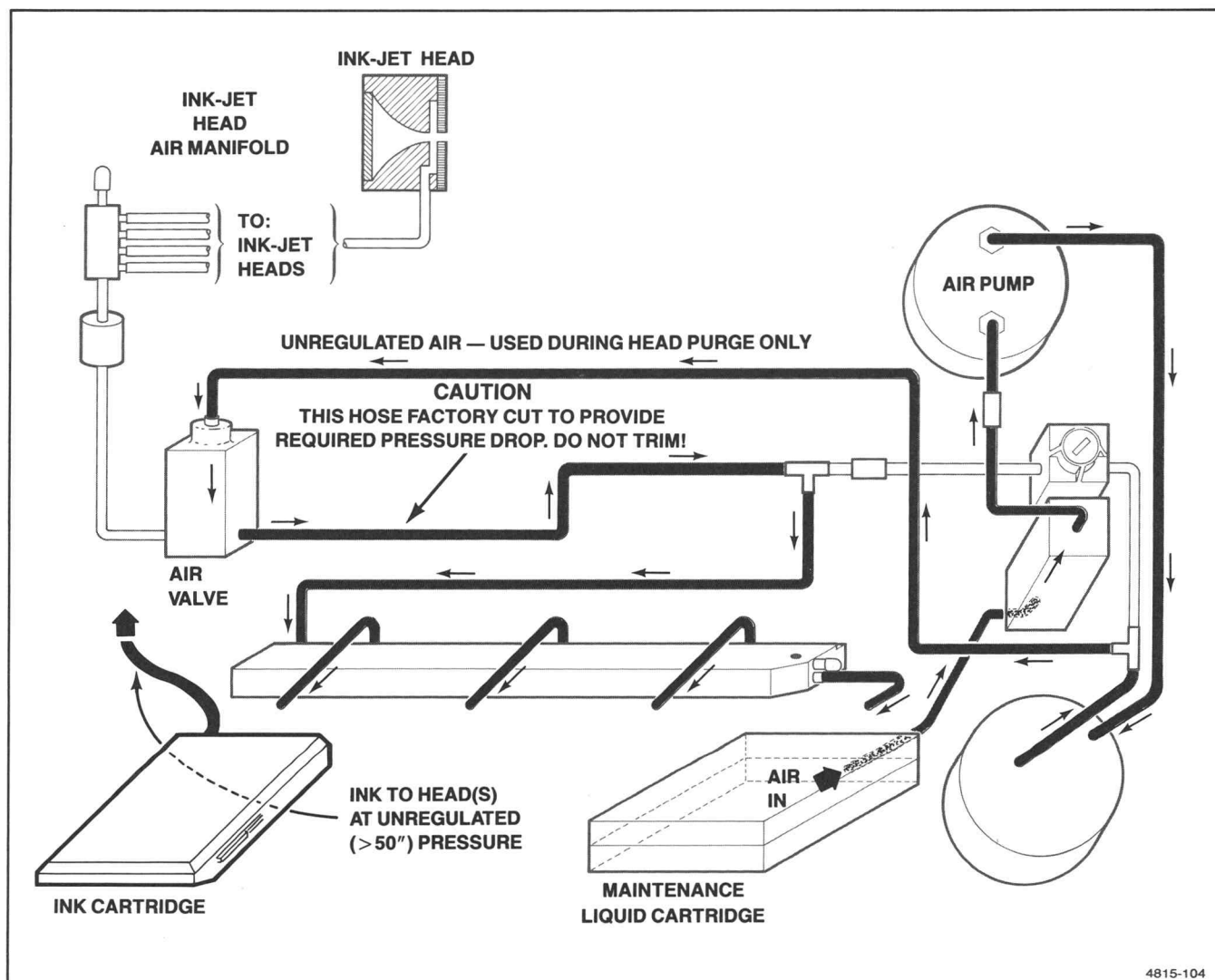
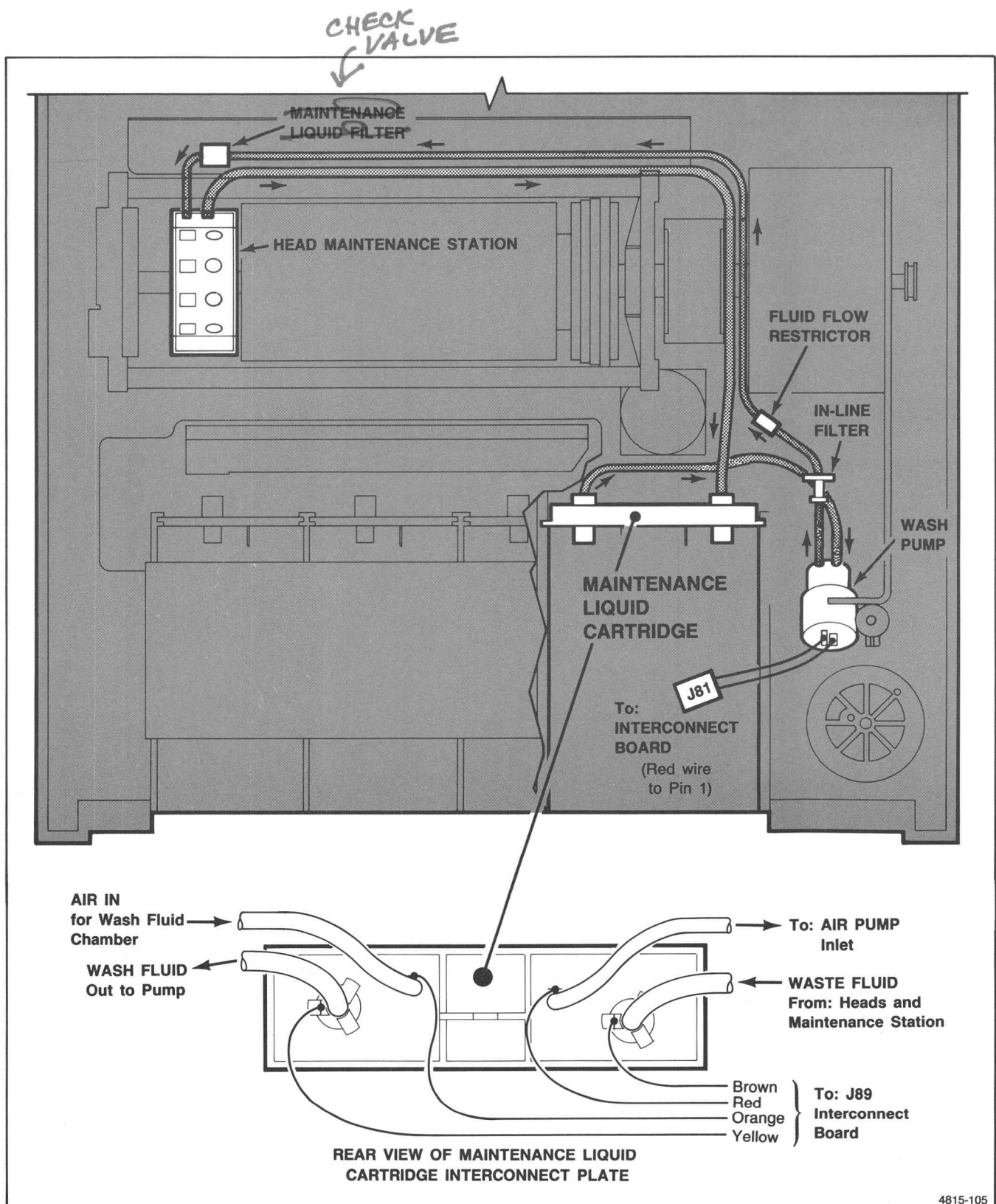


Figure 3-45. Air Flow During Purge.



4815-105

Figure 3-46. Head Maintenance System.

Head Maintenance Station

Whenever the copier is inactive, the head carriage moves to the left end of the carriage rails, where the head maintenance station is located. The head maintenance station provides two "parking" positions for the ink-jet heads. They are:

- **HEAD-CAPPING POSITION-** this position is to the far left of the head maintenance station. The head carriage is positioned here, during the power-down sequence, whenever the copier is turned off. The dome shaped caps of the head-capping position physically seal the ink-jet heads and prevents the ink-jet heads from drying out or becoming contaminated.
- **HEAD-WASH POSITION-** these cup-shaped caps, just to the right of the head-capping position, provides three services for the maintenance of the ink-jet heads.
 - **SHORT-TERM STORAGE.** Whenever the copier is on, but not producing a copy, the head carriage returns ink-jet heads here for protection. When a copy request is made, the copier logic checks the location of the head carriage and will not proceed if the head carriage isn't in the this position.
 - **HEAD WASHING.** When the copier is powered-up, the head carriage moves to this position and a wash cycle is performed. The wash cycle removes any foreign material from the face of the ink-jet heads. The ink-jet heads are also washed after every 40 copies or 20 hours of operation. The cup-shaped caps catch ink, foreign material, and maintenance fluid and route them to the waste chamber of the liquid maintenance cartridge.
 - **INK-JET HEAD PURGING.** The ink-jet head purge function is performed while the ink-jet heads are parked at the head-wash position.

MEDIA HANDLING SYSTEM

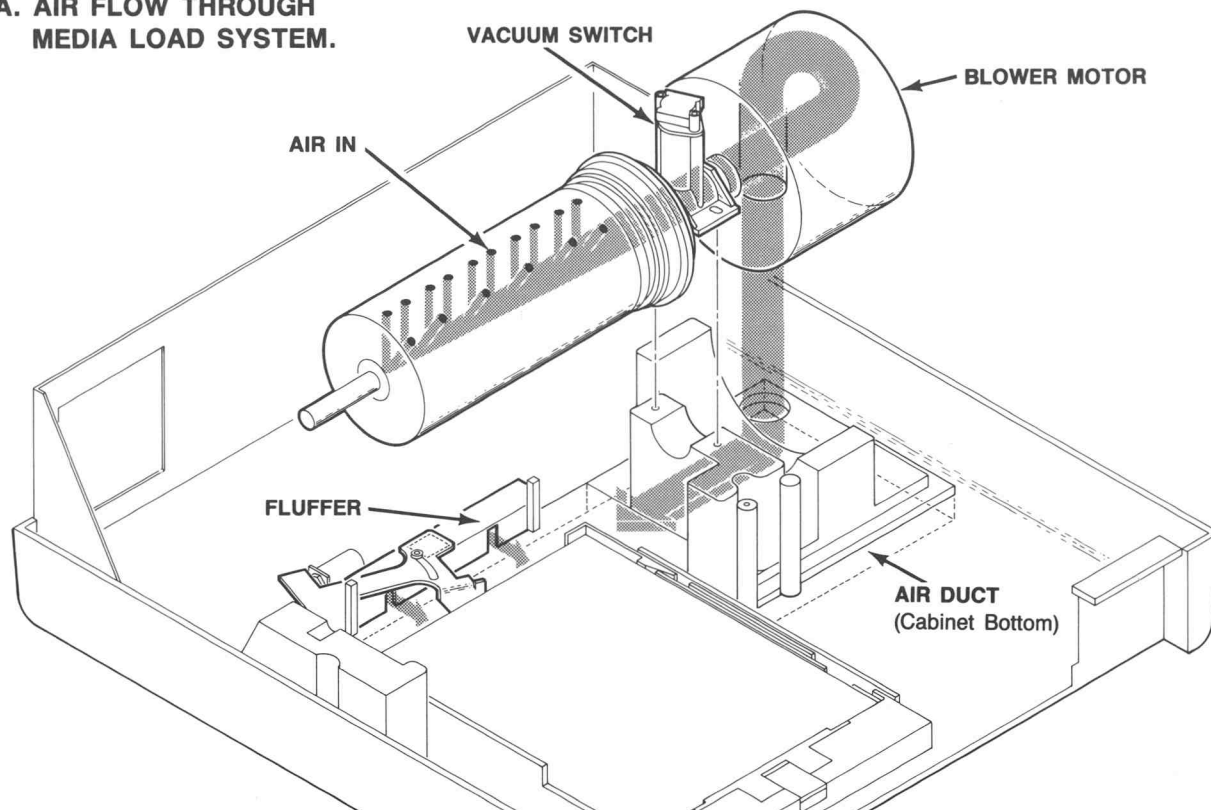
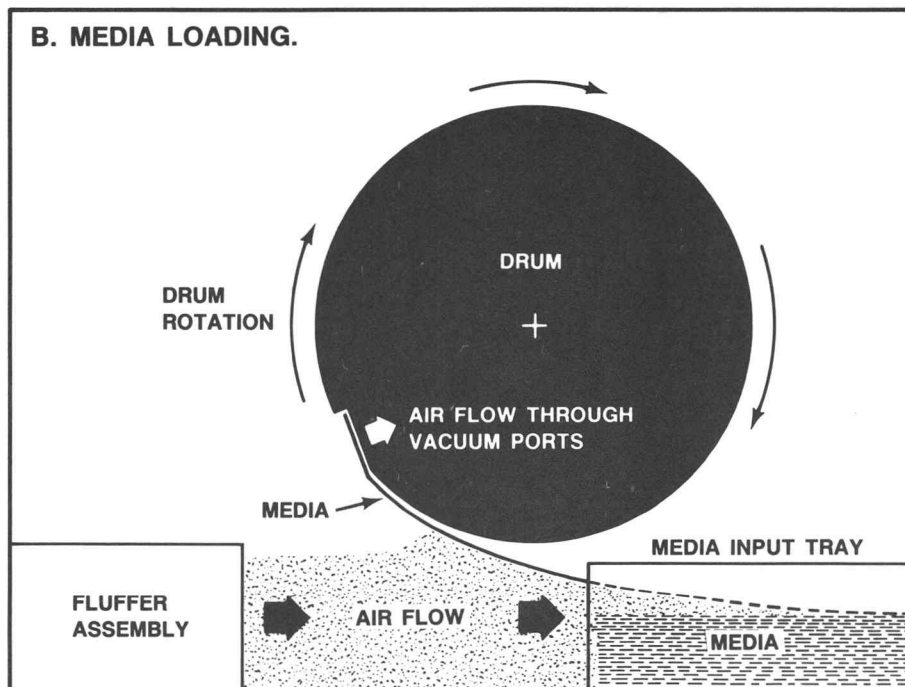
The media handling system consists of the drum, vacuum switch, blower, ducting portion of the bottom cabinet, fluffer assembly, fluffer solenoid, stripper arm, and the stripper solenoid.

Media Loading

When a copy request is received, the copier's Print Engine initiates the mechanical and electro-mechanical components of the system. Figure 3-47 shows the media loading components.

The steps involved are:

1. The Parallel Interface Processor informs the Print Engine Processor that a copy request has been received, and requests the status of the Print Engine.
2. The Print Engine Processor energizes the blower motor. When the vacuum switch mounted between the drum and the blower senses the correct value, the blower maintains a constant speed.
3. The Print Engine Processor energizes the fluffer solenoid which directs the blower exhaust air flow, out of the fluffer assembly, toward the media input tray. This directed air flow lifts (fluffs) the top sheets of media toward the drum.
4. The vacuum in the drum created by the blower draws the leading edge of the sheet of media to the drum and holds it there.
5. The drum begins to rotate and pulls the media out of the input tray. Vacuum holes in the drum hold the entire sheet to the drum which is now rotating at imaging speed.
6. The fluffer solenoid deactivates, which directs the blower exhaust through another port in the fluffer assembly.
7. With the media loaded and the drum rotating at imaging speed, the Print Engine Processor informs the Interface Processor that it is ready to receive image data to print.

A. AIR FLOW THROUGH MEDIA LOAD SYSTEM.**B. MEDIA LOADING.**

4815-106

Figure 3-47. Media Loading System.

THEORY OF OPERATION

Media Unloading

When the copy is completed, the Print Engine must move the media from the drum to the media output tray. To do this the Print Engine:

1. Reduces the drum speed.
2. Energizes the stripper solenoid, at the correct time, to move the stripper fingers toward the drum.
3. The fingers on the stripper arm enter the grooves in the drum and lift the media from the drum. The rotation of the drum ejects the media into the media output tray.

Figure 3-48 shows the media being unloaded.

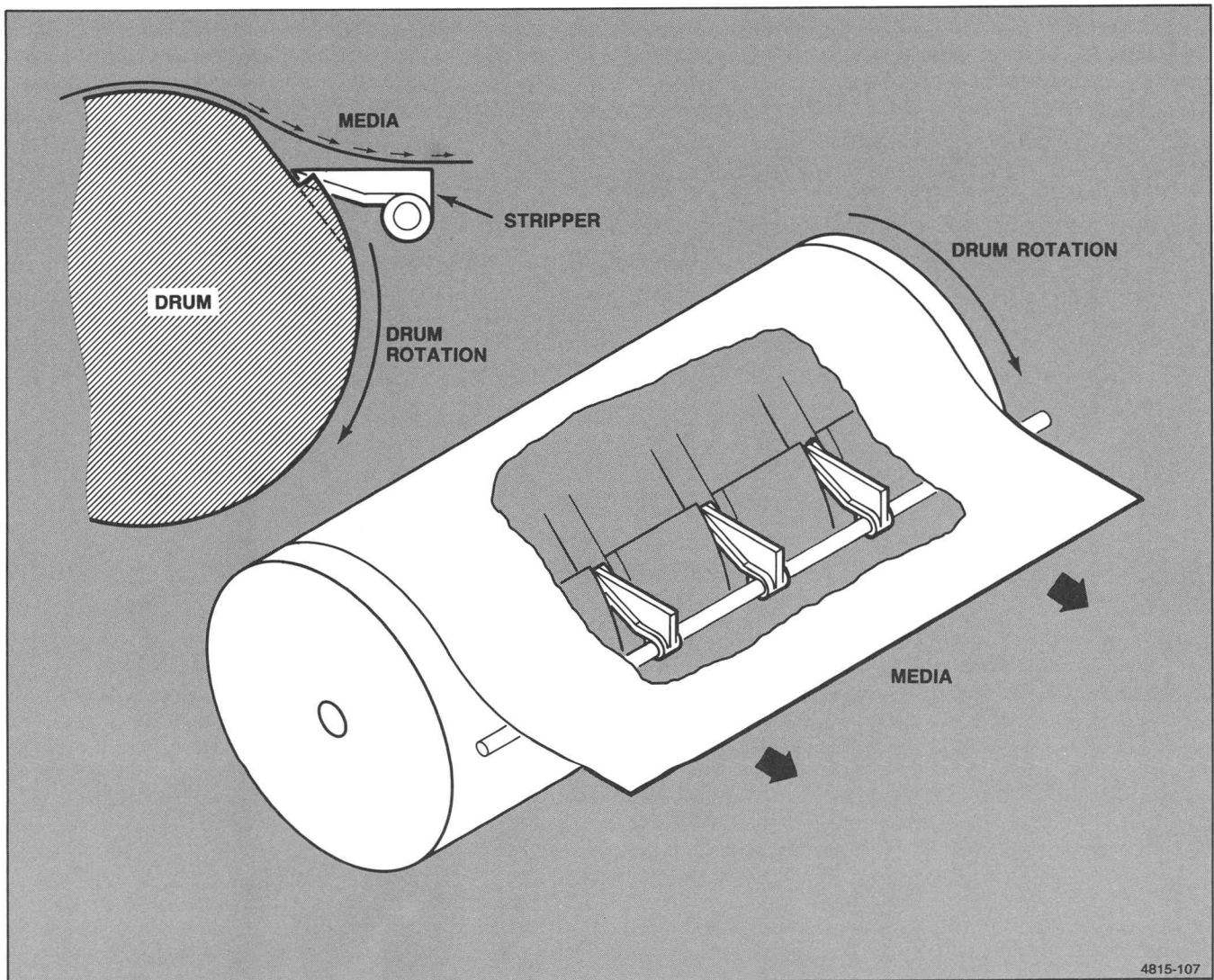


Figure 3-48. Media Unloading.

Section 4

COPIER MAINTENANCE

4.1 INTRODUCTION

This section contains the periodic maintenance procedures for the copier. The copier mechanical design excludes the need for extensive maintenance, and a non-technical operator can perform all of these upkeep procedures.

4.2 PERIODIC MAINTENANCE PROCEDURES

There are nine maintenance procedures to be performed on the copier from time to time. Seven of the nine procedures may be performed by a non-technical operator and are described in the *4692 Color Graphics Copier Operators Manual*, as well as here. Table 4-1 details all nine of the maintenance procedures.

The seven operator maintenance procedures are:

- Adding media to the input tray
- Replacing expended ink cartridges
- Replacing the maintenance liquid cartridge
- Cleaning the head carriage rails and drum
- Cleaning the media stripper and media exit guide
- Cleaning the head maintenance station
- Cleaning the copier cabinet

The other two maintenance procedures, to only be performed by qualified service personnel, are:

- Replacing the maintenance liquid filter
- Purging the Ink Transient Suppressor (ITS) bubble traps

It is a good idea to keep a log detailing the type of services performed, the date, and the media used count. Copiers on a maintenance agreement may have a copy counter inside the copier cabinet to keep track of the total copies made. Those without a copy counter can keep track of how many times they open new paper packages (there are 500 sheets in each package). This log will help in scheduling and keeping track of maintenance.

Anytime the copier is serviced by qualified service personnel, the ITS bubble traps should be inspected, and purged, if necessary.

4.2.1 ABOUT COPIER LUBRICATION

The copier does not require any lubrication. The best protection for mechanical parts is to keep them clean using the operator maintenance procedures. NEVER apply oil to any part as it will only collect dirt.

4.3 OPERATOR PERFORMABLE MAINTENANCE PROCEDURES

The following describes the maintenance procedures which may be performed by either a non-technical operator or qualified service personnel.

4.3.1 REPLACING MAINTENANCE LIQUID CARTRIDGE

Refer to Figure 4-1 for the location of the maintenance liquid cartridge. The approximate life of the maintenance liquid cartridge is about two thousand copies or three months of copier use (under normal operating conditions).

The maintenance liquid cartridge contains two chambers. The top chamber contains new maintenance liquid and the bottom chamber collects the dirty fluid after the copier has used the liquid to wash the ink-jet heads.

The quantity of maintenance fluid remaining is constantly monitored by the copier. Replace the cartridge when the copier's MAINT indicator flashes in conjunction with a steady FAULT indication.

CAUTION

Never use a maintenance liquid cartridge that has leaks or cracks in its case. Otherwise, there may be a mess to clean up. Also, never attempt to refill the cartridge for reuse.

The procedure for Maintenance Liquid Cartridge replacement is:

1. Press POWER OFF and wait for the POWER indicator to go out.
2. Open the consumables access door and locate the maintenance liquid cartridge. It is located below and to the right of the yellow ink cartridge. Lay an absorbent towel on the consumable access door to collect any spillage from the cartridge as it is removed.
3. Grasp the cartridge handle, lift slightly (less than $\frac{1}{8}$ "), and slowly pull it out from the copier. Discard the used cartridge.

Table 4-1
PERIODIC MAINTENANCE SCHEDULE

Time Interval or Hours of Copier Use (whichever comes first)	Approximate Number of Copies	Maintenance Procedure	To be performed by
When the copier runs out of media (paper or transparency film)	100 sheets for paper, 50 sheets for film	Add more media of the type needed. ^a	Operator
When the copier requires a new ink cartridge (about six months)	4000	Replace used cartridge with new ink cartridge of the same color. ^a	Operator
When the copier requires new a maintenance liquid cartridge (about three months)	2000	Replace used cartridge with a new maintenance liquid cartridge.	Operator
Monthly	N/A	Clean head carriage rails and drum with a moist, lint-free cloth.	Operator
As needed	N/A	Clean media stripper and media exit guide with a moist lint-free cloth.	Operator
Every three months or 500 hours	2000	Clean head maintenance station.	Operator
As needed	N/A	Clean dust and ink residue from cabinet.	Operator
Every year	N/A	Replace maintenance liquid filter.	Qualified Service
Every year or when a bubble trap fills with air ^b	5000	Purge ITS bubble traps.	Qualified Service

^a See Section 4 of the Operators manual for detailed procedures.

^b The ITS bubble traps should be inspected, and purged if necessary, whenever the copier is serviced.

4. Remove any protective tape from the connecting end of the replacement cartridge.

NOTE

The cartridge cannot be installed upside down because tabs on the cartridge sides fit only one way inside the copier slot. Refer to the label on the cartridge handle to locate the top side of the cartridge.

CAUTION

For copiers installed at high altitude sites, it is recommended that the maintenance cartridge be purged of any internal pressure buildup before insertion into the copier. Hold the cartridge upright (handle at the bottom and the four interconnect holes at the top). Slightly depress each seal (inside the interconnect holes) with a small paper clip so any pressurized air can escape. If you fail to do this, air pressure inside the cartridge may expel maintenance fluid into the copier cabinet during cartridge installation.

5. Hold the cartridge so the label is up, and gently slide the new cartridge into the empty slot. Then slowly and firmly press on the cartridge until the side latching tabs drop and lock in place.
6. Press POWER ON to continue with copier operation.

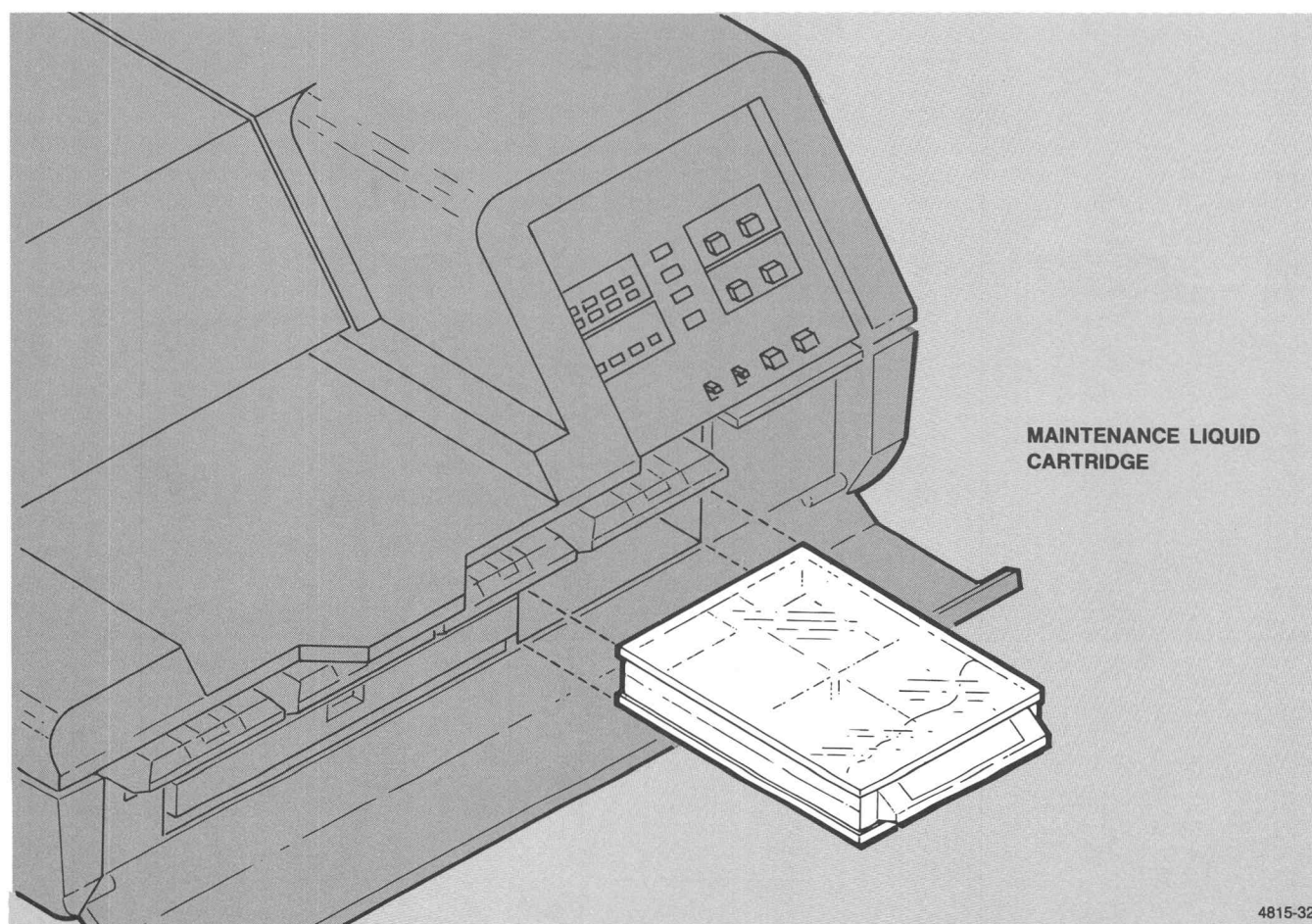


Figure 4-1. Maintenance Cartridge Location.

4815-32

4.3.2 CLEANING HEAD CARRIAGE RAILS AND DRUM

Perform the following procedures for cleaning the head carriage rails and rotating drum (see Figure 4-2):

1. Press POWER OFF (if the copier is turned on) and wait for the POWER indicator to go out.
- 1a. *Remove the four ink cartridges.*
2. Unplug the copier's power cord and open the copier's top cover door.

CAUTION

Use only a lint-free cloth and clean water to clean the following assemblies.

3. Clean the drum assembly by wiping it with a dampened lint-free cloth while you manually rotate the drum. Pay particular attention to the vacuum ports, which hold the leading and trailing edges of a media sheet, and also to the paths on the drum traveled by the stripper fingers.

While cleaning the drum, insure the vacuum port covers are correctly plugged and that no vacuum port covers are missing — see the Operators manual for correct vacuum port cover placement.

4. Clean the exposed carriage rails with a dampened lint-free cloth — see Figure 4-2.

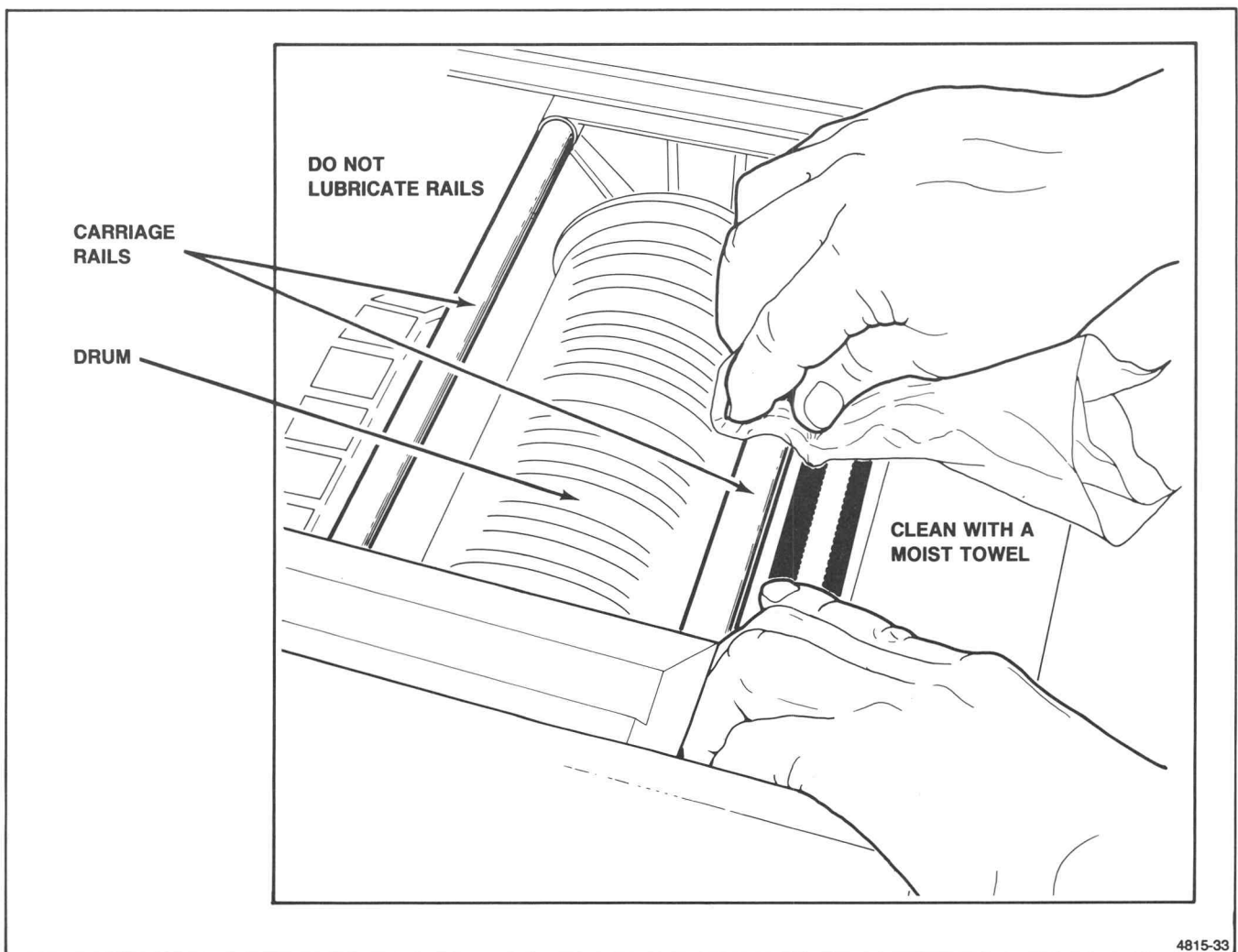


Figure 4-2. Cleaning the Carriage Rails and Drum.

5. Move the head carriage assembly to the right by pulling the carriage drive belt. You must always use the drive belt to manually move the head carriage.
6. Clean the exposed portions of the drum and the carriage rails.
7. Close the copier's top cover door and reconnect the power cord.
- 7a. *Reinsert the four ink cartridges*
8. Once cleaning is finished, press POWER ON. The copier will properly relocate the head carriage assembly over the maintenance station. The copier will give a fault indication (FAULT + PORT-2 lit) to show that the head carriage was not in the capping position upon power-up. Press CLEAR to remove the fault indication.

4.3.3 CLEANING MEDIA STRIPPER AND MEDIA EXIT RAMP

If ink smudges appear on printed copies as they come off the drum, use the following procedure to clean the remaining media handling parts — see Figure 4-3:

1. Press POWER OFF (if the copier is on) and wait for the POWER indicator to go out.
2. Unplug the copier's power cord and open the copier's top cover door.
3. Check the stripper fingers and media exit ramp (in front of drum) for ink deposits. If dirty, clean with a moist lint-free cleaning paper (such as KIMWIPES®). Ensure the paths on the drum traveled by the stripper fingers are clean.
4. Close the top cover door and plug in the power cord.

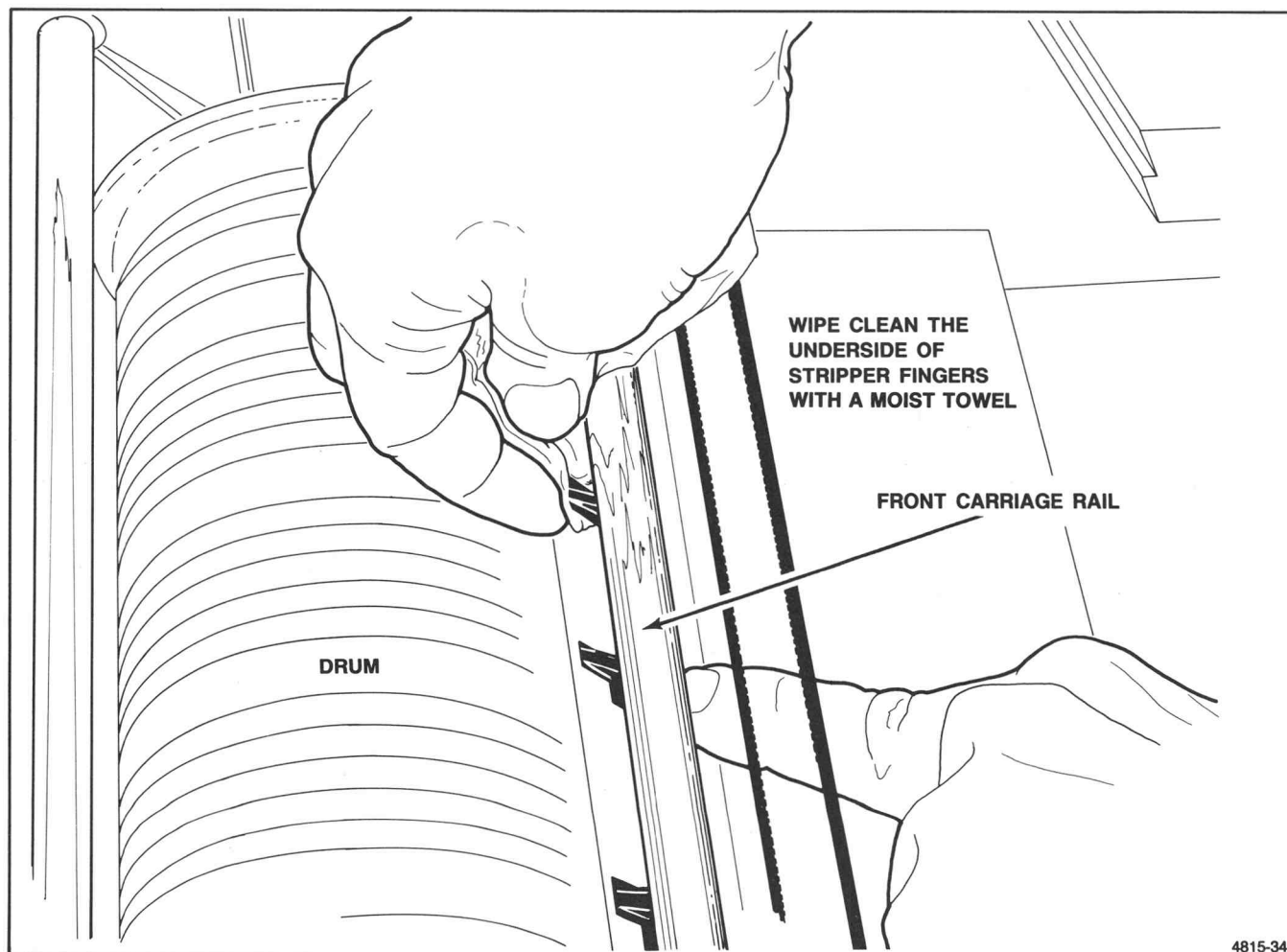


Figure 4-3. Cleaning the Stripper.

4.3.4 CLEANING THE HEAD MAINTENANCE STATION

Refer to Figure 4-4 to locate the head maintenance station. Perform the following procedure:

1. If the copier is on, press POWER OFF and wait for the POWER indicator to go out.
- 1a. *Remove the four ink cartridges*
2. Unplug the copier's power cord, and open the copier's top cover door.
3. By pulling on the carriage drive belt, manually move the head carriage assembly gently to the right to expose the maintenance station.
4. Clean the maintenance station gutter area (pointed out in Figure 4-4) with a moist lint-free cleaning paper (such as KIMWIPES®). Moisten and use a clean portion of the cleaning paper to:
 - a. First, individually clean each dome-shaped head cap. Be sure to use a new, moist, clean paper on each cap.
 - b. Next, clean the outside of each individual wash cup. Be sure to use a new, moist, clean paper on each cup.
 - c. Last, clean the chrome surface of the head maintenance station.
 - d. *Reinstall the four ink cartridges.*
5. Once cleaning is finished, connect the power cord to the copier and press the POWER ON switch. The copier will properly relocate the head carriage assembly over the maintenance station. The copier will give a fault indication (FAULT + PORT-2 lit) to show that the head carriage was not in its power-up position. Press CLEAR to remove the fault indication.

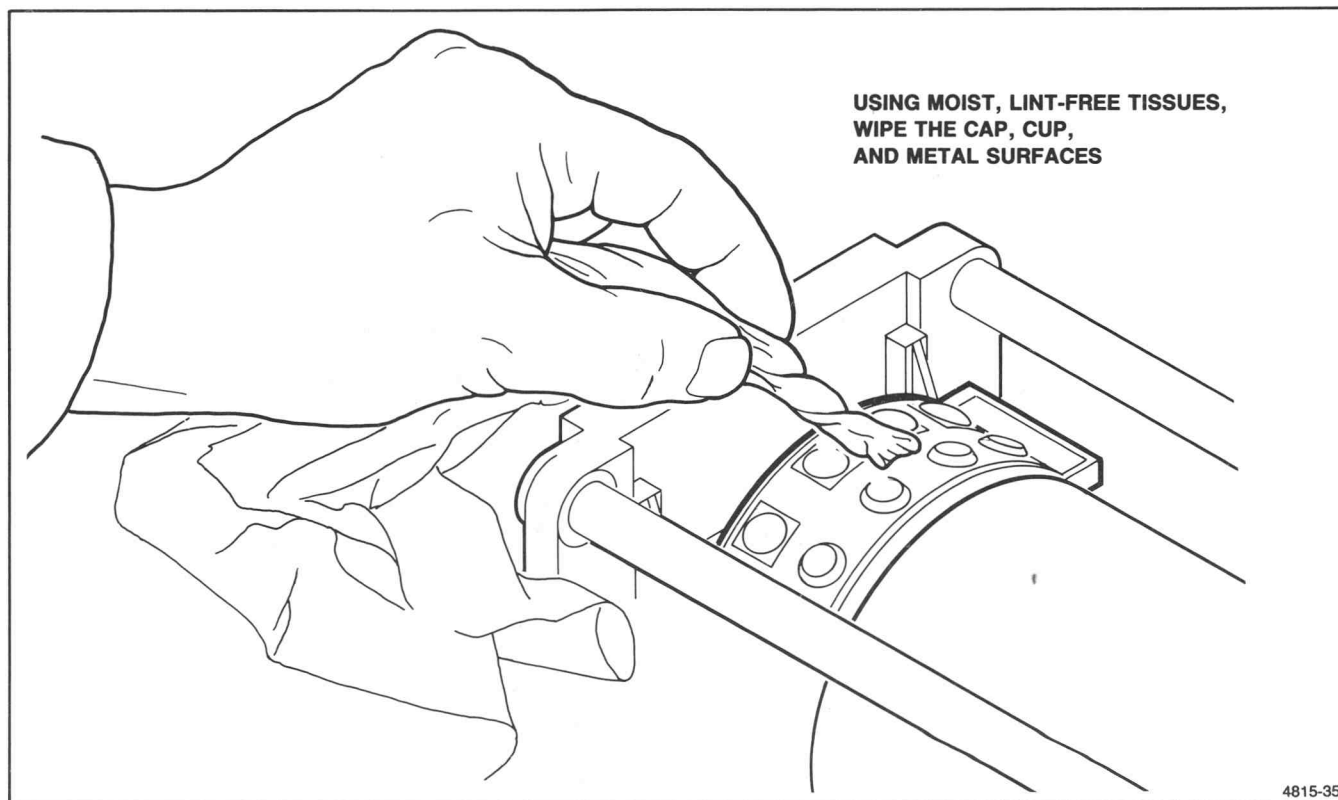


Figure 4-4. Cleaning the Head Maintenance Station.

4.3.5 CLEANING THE CABINET

To maintain the appearance of the copier, keep it free from dust and dirt buildup.

CAUTION

Avoid the use of chemical cleaners containing benzene, toluene, xylene, acetone, or similar agents as they will damage plastics used in this instrument.

Cleaning the Outside of the Cabinet

The cabinet exterior should be kept free from loose dirt or dust. Clean the cabinet with a brush or dry cloth to remove any dirt or dust. The cabinet exterior should be cleaned periodically using a soft cloth dampened in a mild detergent solution. Never use an abrasive cleaner because abrasives remove paint as well as dirt.

Cleaning the Inside of the Cabinet

Small amounts of dust and paper particles can collect inside the copier. Press POWER OFF. Once the POWER indicator goes out, disconnect the power cord from the rear of the copier and remove the top cover — see Section 6.2.1 “Top Cover”. Remove any dust and particles with a lint-free damp cloth.

CAUTION

DO NOT use pressurized air to clean the inside of the copier.

To prevent ink-jet damage when cleaning the copier, DO NOT touch or clean the surface of the ink-jet heads, or disturb the ink lines (black rubber tubing).

4.4 QUALIFIED SERVICE PERSONNEL PROCEDURES

The following maintenance procedures should only be performed by qualified service personnel.

4.4.1 REPLACING THE MAINTENANCE LIQUID FILTER

The maintenance liquid filter should be replaced every year. The filter is connected in-line between the maintenance liquid supply tube and the head maintenance station. The filter is located behind the head maintenance station. To replace the filter:

1. Power-down the copier and wait for the POWER indicator to turn off.
2. Remove the power cord and the copier top cover — see Section 6.2.1 “Top Cover”.
3. Locate the filter behind the head maintenance. You may want to move the head carriage assembly to the right (by pulling on the carriage drive belt) to provide easier access to the filter.
4. Place an absorbent towel under the filter. Clamp the supply hoses shut at both ends of the filter and then remove the hoses from the filter. The towel will catch any fluid dripping from the filter and clamped hoses.
5. Install the new filter in place of the old filter. Ensure the arrow (indicating fluid flow direction) on the filter points to the head maintenance station.
6. Remove the clamps and absorbent towel.
7. Reinstall the copier top cover and the power cord.
8. Power-up the copier. The copier will properly relocate the head carriage assembly and indicate a fault (FAULT + PORT-2) to show that the head carriage was moved. Press CLEAR to remove the fault.

4.4.2 INK SYSTEM PURGING

There are three procedures you may perform to purge the copier's ink system. Each procedure purges a different portion of the ink system.

- *Purging The Ink-jet Heads*, purges air and other foreign matter from the ink-jet heads and is initiated at the front panel. This is the only purge procedure which may be initiated by the operator (by pressing the PURGE switch).
- *Purging The Ink Supply Lines*, allows you to purge air from the ink supply lines between the ink cartridges and the ink-jet head assemblies.
- *Purging The ITS Bubble Trap*, allow you to remove any air collected in a special chamber in the Ink Transient System (ITS) that traps air bubbles in the ink before they reach the ink-jet heads. The bubble traps should be inspected, and purged if necessary, every time the copier is serviced.

About Ink-jet Head "Flooding"

To minimize the induction of air bubbles into the ink-jet heads, the copier can "flood" the air chamber (chamber 3) of the ink-jet heads with ink. This action automatically takes place every time the copier is powered-down. You may also manually flood the ink-jet heads by entering Service mode Test 1 (the Air Routine) and pressing PURGE to shut off the air flow to the heads. After twenty seconds the ink-jet heads will be flooded. Naturally, the 3-way valves must be open to accomplish this.

You should flood the ink-jet heads prior to servicing the ink-jet heads or ink plumbing with the copier powered-up. This greatly minimizes the chance of inducing air into the ink-jet heads.

Purging The Ink-jet Heads

The PURGE button initiates an extended cleaning and purging cycle of the ink-jet heads at the head maintenance station for approximately 90 seconds. The purge action helps clear foreign matter and trapped air that might cause the ink-jets heads to have printing difficulties.

The following text describes the ink-jet head purge procedure. This method resolves most ink-jet head problems. To use the PURGE function, do the following:

1. Make sure the READY indicator is on and the copier is not reserved (a reserved state is indicated by a PORT indicator flashing — press CLEAR to remove a reserved state).
2. Press the PURGE button. Purging the ink-jet heads takes about 90 seconds. During this time, the MAINT indicator stays lit. This is normal and indicates the purge is taking place. Wait until the purge is finished before pressing ANY other buttons.

NOTE

When the copier purge is complete, MAINT, and INK LOW indicators should be off. The copier will not operate when the indicators are flashing indicating an ink or maintenance cartridge requires replacing.

3. When the ink-jet head purge is finished, press the TEST button to print a test pattern.
4. If necessary, repeat the purge procedure at least two more times if the first effort was unsuccessful.

See change info.

1. Open the top cover door. Insert an opaque object in the door interlock sensor.

COPIER MAINTENANCE

Purging The Ink Supply Lines

If the copier is subjected to altitude (pressure) or broad temperature changes, small bubbles may develop in the ink supply lines to the ink-jet head assemblies. The following instructions tell you how to purge the bubbles out of the ink supply line. Performing this procedure greatly enhances the long-term reliability of the copier. You may purge the ink lines individually or all at once.

1. Remove the top cover — see Section 6.2.1 "Top Cover".
2. Remove the head carriage cover to gain access to the ink-jet valves.
3. Connect a 12 inch piece of 3/16" inside diameter tubing to the purge ports of each 3-way valve — see Figure 4-6. Place the free end of the tubing in a waste container to catch the "old" ink. Depending on your intentions, you may only need to connect the tubing to one, two, or three of the 3-way valve purge ports.
4. Power the copier up (if not already powered-up).
5. Enter the copier Service mode and start the Air Routine (TEST #1). This pressurizes the ink system.
6. Pressing the PURGE switch shuts off the air supply to the ink-jet heads.
7. Turn the 3-way valves to the Purge position — see Figure 4-5.
8. Lightly tap the ink supply lines with your finger (not fingernail) to knock loose any air bubbles clinging to the inner wall of the lines. Allow the purging process to continue for 10 seconds.
9. Turn each ink-jet valve to the Open position — see Figure 4-5.
10. Press STOP COPY to exit Service Test 1 and then select Service Test 2 (the Wash Routine) to wash the ink-jet heads. Press PURGE to activate the wash pump.
11. Press STOP COPY and then CLEAR to exit Service mode.
12. Remove the tubing from the purge ports of the ink-jet valves.
13. Reinstall the head carriage cover and then the copier top cover.

Purging The ITS Bubble Trap

Each ink-jet head assembly's Ink Transient Suppressor (ITS) features a bubble trap. The bubble trap is the transparent, top-most section of the ITS. As the name implies, the bubble trap's purpose is to trap and collect any air bubbles forming in the ink supply lines as they are carried to the ink-jet heads. Each ink-jet head will continue to operate until its bubble trap is *completely* full of air. Each bubble trap should only be purged of air when the bubble trap chamber becomes more than 30% full of air. The four bubble traps should be inspected every time you service the copier.

The Bubble Trap Purge Procedure. You should inspect the ITS bubble traps every time the copier is serviced.

1. Power down the copier. After the POWER indicator turns off, open the top cover door.
2. Remove the head carriage cover and observe each ink-jet head assembly's bubble trap. If the bubble trap chamber is more than 30% full of air, then it requires purging — see Figure 4-6.
3. Close the 3-way valves of the ink-jet heads whose bubble traps DO NOT require purging.
4. Perform the ink-line purge procedure (see the procedure "Purging The Ink Supply Lines" in this section) for the ink supply line of the bubble trap to be purged.
5. Once you complete the ink-line purge, enter Service mode (the READY and FAULT lights flash together when you enter Service mode).
6. To pressurize the ink system, start Service Test 1. The blower motor and air pump will start to pressurize the ink system. The BLACK INK LOW light illuminates to indicate that air is flowing to the ink-jet heads.
7. Pressing the PURGE switch shuts off the air flow to the ink-jet heads, allowing them to "flood" with the pressurized ink. The BLACK INK LOW light will turn off to indicate that there is no air flow to the ink-jet heads.
8. Clamp the purge tube of the bubble trap to be purged. Close the 3-way valve to the bubble trap — refer to Figure 4-6.
9. Loosen the 7/64" Allen screw attaching the ink-jet head assembly to the head carriage. Remove the ink-jet head assembly from the head carriage. Do not disconnect any of the ink or air tubes.

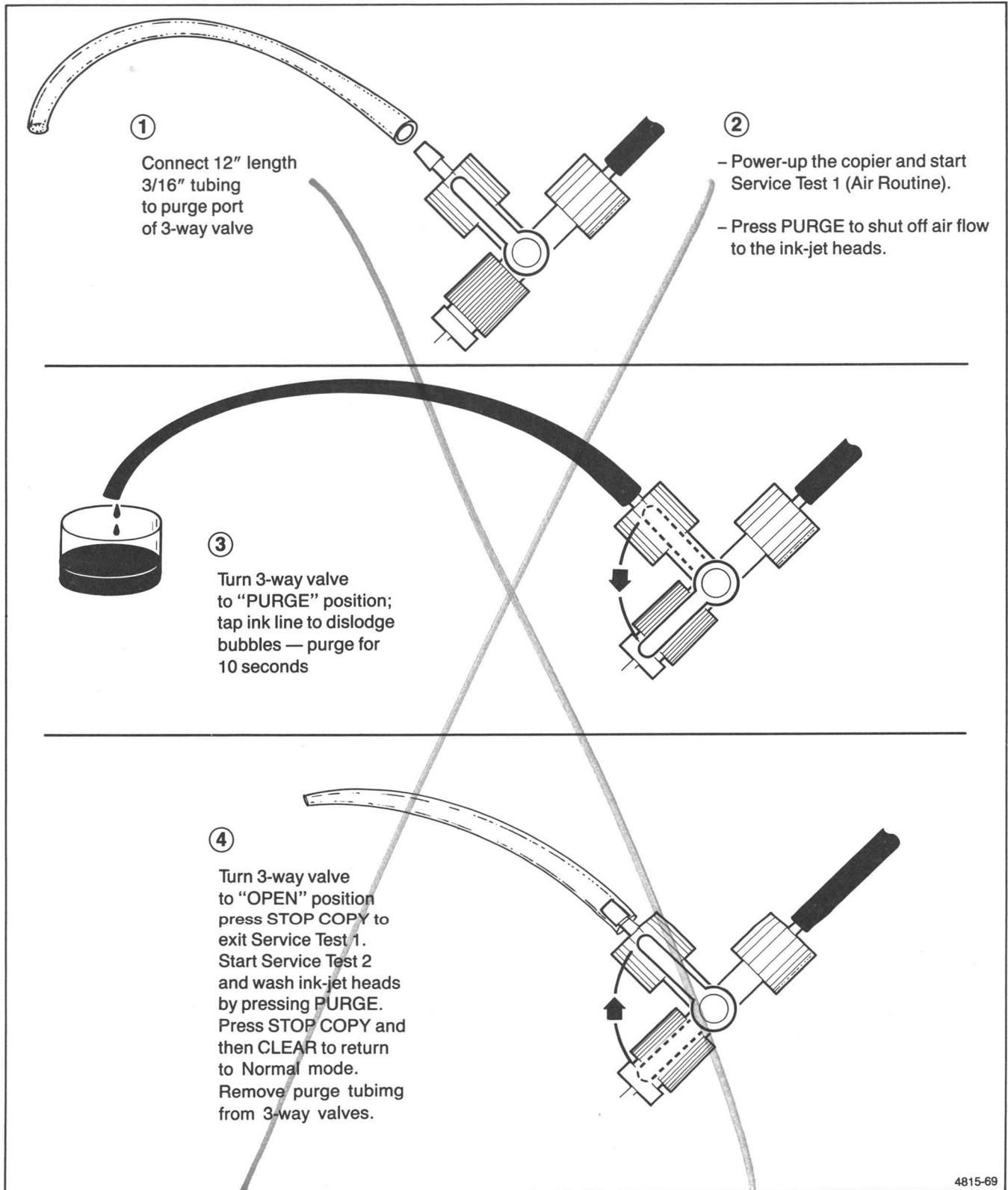


Figure 4-5. Purging the Ink Supply Lines.

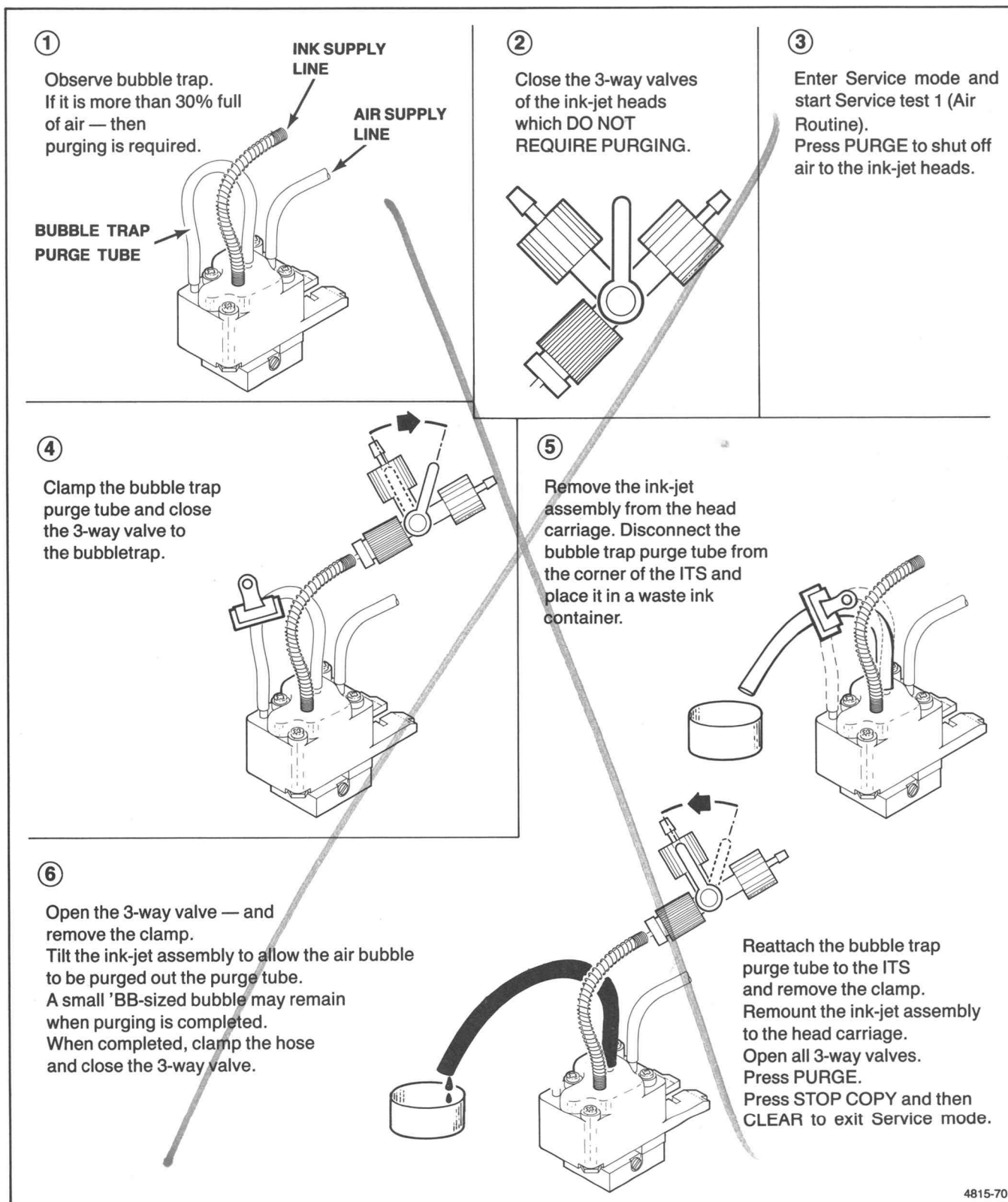


Figure 4-6. Purging the ITS Bubble Trap.

COPIER MAINTENANCE

10. Disconnect the end of the bubble trap purge tube connected to the corner "nipple" of the ITS — see Figure 4-6. Place the free end of the tube in a waste container to catch the ink that forces the air bubble out of the bubble trap.
11. Tilt the ink-jet head assembly to move the air bubble in the bubble trap to the purge tube. If necessary, lightly tap the ITS with your finger (not fingernail) to move the bubble.
12. First, open the 3-way valve to the bubble trap being purged and then remove the clamp on the purge hose. The ink flow should force the air bubble out through the bubble trap purge tube and into the waste container. Lightly tap the ITS with your finger (not fingernail), if necessary.
13. When most of the bubble is removed from the bubble trap, clamp the hose and then close the 3-way valve. You would waste too much ink in trying to remove all the air from the bubble trap. A small "BB-sized" bubble remaining in the bubble trap is normal.
14. Reattach the free end of the purge tube to the corner "nipple" of the ITS and remove the clamp.
15. Remount the ink-jet head assembly to the head carriage. Tighten the 7/64" Allen screw.
16. Open all the 3-way valves.
17. Press PURGE to restore air flow to the ink-jet heads. The BLACK INK LOW light will illuminate to indicate this.
18. Press STOP COPY to exit Service Test 1, and then press CLEAR to exit Service mode.
19. Run a purge cycle by pressing the PURGE switch.
20. When the purge cycle ends, run Test Pattern 3 (Convergence) to verify ink-jet head convergence. Adjust convergence if necessary. Refer to Section 5.4.1 "Checking Ink-jet Head Performance".

Section 5

CHECKS AND ADJUSTMENTS

5.1 INTRODUCTION

This section provides the procedures for maintaining copier performance. If any mechanical function does not operate properly, use these procedures to correct the problem.

Although this information falls into two major categories, electrical and mechanical, the design of the copier negates the need for extensive electrical adjustment procedures.

The contents are:

- Safety Summary
- Required Tools
- Setup
- Power-up Self Test

Mechanical Checks

- Check/set air pressure (Service test #1)
- Media Input Tray Adjustment
- Check/adjust carriage drive belt tension
- Check/adjust fluffer/paper loading position (Service test #3)
- Check/adjust head maintenance station tension (Service test #2)
- Check/adjust drum to angle (service loop) bracket position

Electrical Checks and Adjustments

- Check input power setting
- Check internal power supplies
- Check/set ink-jet head drive voltages (Service test #4)

Imaging (ink-jet) Checks

- Check ink-jet head performance:
 - Threshold voltage (check/adjust)
 - Convergence (check/adjust)
 - Solid Fill (check)
 - Frequency (check)

CHECKS AND ADJUSTMENTS

5.1.1 SAFETY SUMMARY

The following safety procedures should be followed to avoid injury to yourself or damage to the copier.

FLUIDS- The inks and wash fluids used in this product are non-toxic and therefore require no special health or safety precautions. Since the inks contain semi-permanent dyes, we suggest the use of protective garments to avoid stains on your clothing while servicing the copier.

ROTATING MACHINERY- This instrument contains rotating machinery. Jewelry, long hair, clothing, or any material that may become entangled should be secured prior to operating the copier with the top cover opened or removed. Beware of the rotating counterweight on the air pump.

ELECTRICAL- When the power cord is connected to the rear panel, the + 28 volt supply is active. This voltage is present on the large filter capacitor located next to the power transformer. When the power cord is connected, use care when working inside the copier. Always remove the power cord prior to removing or replacing any electrical component.

OPERATIONAL- Always ensure that the ink cartridges are installed whenever performing a power-up, power down, or any function that activates the vacuum motor and air pump. Failure to do so may introduce air into the ink-jet heads and render them inoperative.

CAUTION

DO NOT unplug the power cord before pressing the POWER OFF switch and allowing the copier to complete the power-down sequence. During the power-down procedure, the copier performs an ink-jet head "flooding" procedure that protects the ink-jet heads from contamination and drying out.

The copier should not be bumped or tilted during operation.

5.1.2 REQUIRED TOOLS

When adjusting the copier, the following tools are needed:

- Flat blade screwdriver (3/16" x 4")
- Phillips screwdriver (#2 x 8")
- Small flat blade screwdriver
- 1/4" nutdriver
- 7/64" allen wrench
- Push/pull spring scale (0-15 lbs.)
- Thickness gauge set

Test equipment requirements are:

- Air Pressure gauge (0 – 50" of water) with 3/16" (inside diameter) tubing (Tektronix P.N. 006-6219-00)
- Oscilloscope – Tektronix model 2236 or equivalent
- Threshold Voltage Pattern Generator (Tektronix P.N. 067-1204-00)

Cleaning material:

- Kimwipes® or absorbent lintfree towels
- Hand cleaner

5.1.3 CHECK/ADJUSTMENT SETUP

Since these procedures may be performed separately (as a check of a particular function) or together (as a comprehensive service call), each assumes that you do the following:

1. Power-down the copier.
2. Disconnect any interface cables connected to the rear panel.
3. Check that all consumables supplies (ink, maintenance fluid, and media) are adequate.
4. Remove the top cover — see Section 6.2.1 “Top Cover.”
5. Power-up the copier, if necessary, to execute the check/adjustment.

Upon completing the check/adjustment(s) you must:

1. Power-down the copier.
2. Reinstall the top cover — see Section 6.2.1 “Top Cover.”
3. Power-up the copier and verify copier performance.
4. Reconnect the interface cable(s).

5.1.4 POWER-UP AND SELF-TEST

When the POWER ON switch is pressed, the copier begins executing the power-up self-test. This internal verification includes checking:

- The fluid levels of the ink and maintenance cartridges.
- If the head carriage was properly placed in the capping position when the copier was last used.
- If the top cover door (door switch) is open or closed.
- Stepper motor operation while moving the ink-jet heads from the capping position to the head wash position.
- Blower operation and vacuum check.
- Electronic circuitry functions which include:
 - ROM and RAM locations
 - Image data path
 - General electronic functionality

If any problems are sensed, the front panel FAULT indicator alerts the operator to investigate further. The copier provides two levels of error code reporting which are described in Section 2.2 “Overview of Fault Indicators (Front Panel)” and also listed in Appendix J *Error Codes*.

CHECKS AND ADJUSTMENTS

5.2 MECHANICAL CHECKS AND ADJUSTMENTS

Although the copier contains complex electro-mechanical components, the copier's design eliminates the need for lengthy, time consuming mechanical adjustments. The following procedures are all the checks/adjustments required for these mechanical systems.

5.2.1 AIR PRESSURE

The regulated air system pressurizing the ink cartridge manifold and the ink-jet head manifold must maintain constant pressure for proper operation of the ink delivery system. These steps identify the procedure for checking and/or adjusting the air pressure.

1. Remove the cap from the pressure gauge connection point on the head carriage air manifold, and connect the pressure gauge as shown in Figure 5-1.

CAUTION

DO NOT allow the cap to get dirty, or introduce contaminants into the air system at the connection point — there are no filters between this point and the ink-jet heads.

2. Power-up the copier and place the copier in Service mode by:
 - a. Depressing the STOP COPY switch, press and release the TEST switch.
 - b. Release the STOP COPY switch, and observe that the READY, and FAULT indicators are flashing. The copier is now in Service mode.

When TEST is pressed, the PORT indicators cycle in sequence (Port 1 to Port 4). Each lit PORT indicator represents a different test sequence.

3. Start Service Test 1 by pressing TEST until the Port 1 indicator is lit and then release the switch. The blower motor will start running.

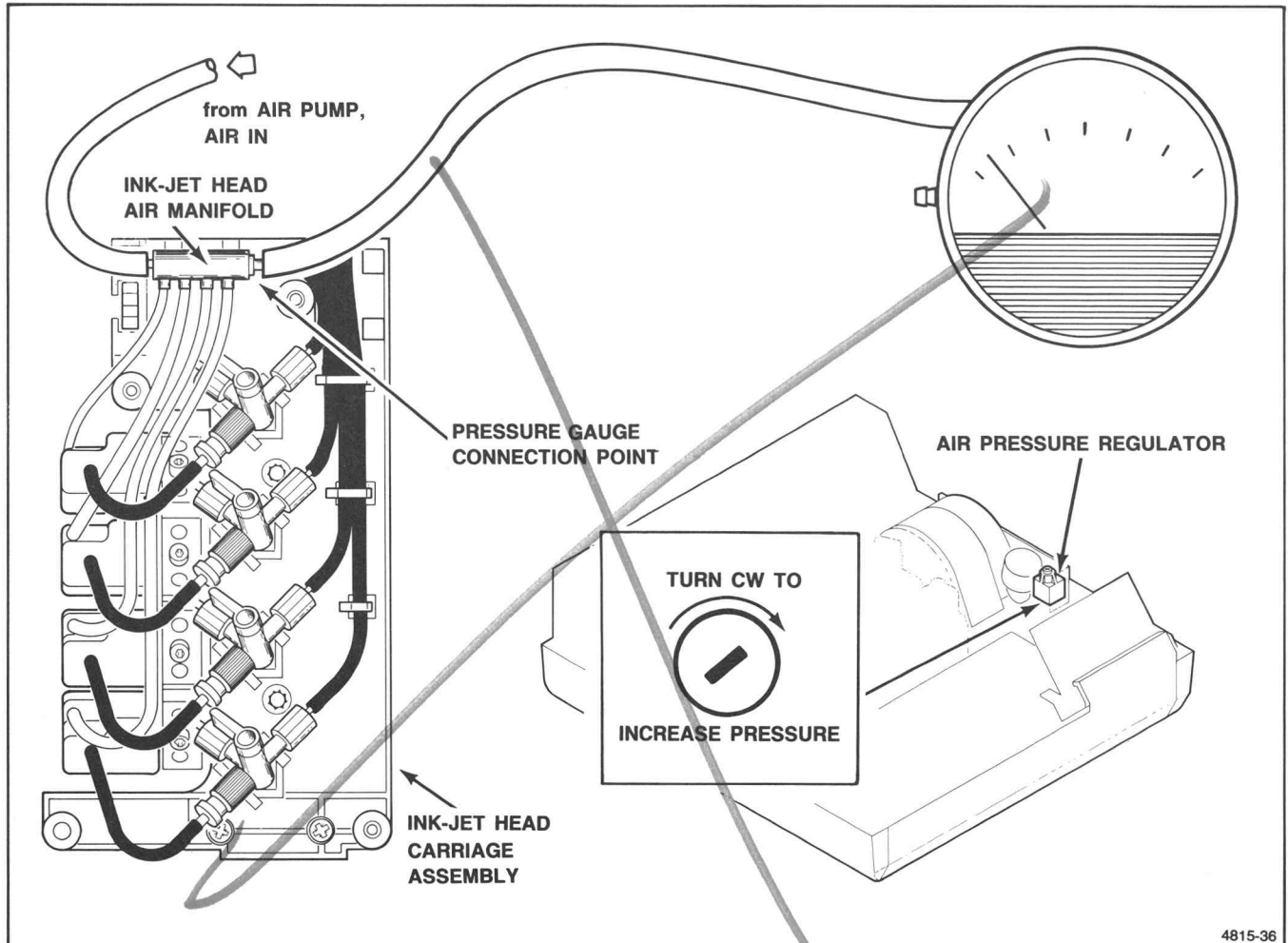
HINT — If you miss your port, don't dismay, and don't release the switch. It'll come around again! Just wait until all four ports have lit, and then Port 1 will light again.

4. Allow the system pressure to equalize, and check for 31 inches (± 1 inches) of air pressure. Adjust the air pressure regulator (see Figure 5-1) if necessary.
5. When this adjustment is complete, press STOP COPY to return the copier to idle in Service mode.
6. Let the air pressure bleed down, re-energize the Service Test 1 (Air Routine) and verify the adjustment. Read the gauge again, and check for pressure change.

NOTE

The regulated air system relies on the integrity of the system components. If an ink cartridge or maintenance cartridge is cracked or an air line is loose, the pressure gauge will show an excessive loss of pressure. A close check at this time could eliminate a problem or service call in the future.

7. Press STOP COPY and then CLEAR to exit Service mode. Wait at least 30 seconds to allow the pressure to "bleed off," and then remove the pressure gauge.
8. Reinstall the cap onto the head carriage air manifold.



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Figure 5-1. Air Pressure Check/Adjustment

Replace and change info.

CHECKS AND ADJUSTMENTS

5.2.2 MEDIA INPUT TRAY ADJUSTMENT

CAUTION

Never install damaged media (curled, folded, or torn media) in the media input tray. If damaged media incorrectly loads on the drum and flaps against the ink-jet heads, poor print quality can result.

The media input tray inserts into the copier through the opened consumable access door. The tray holds either 100 sheets of paper or 50 sheets of transparency film with 50 separator sheets (about $\frac{3}{8}$ " thick total).

The tray has three adjustments that compensate for media width, length, and size — see Figure 5-2. The three adjustments are the Media-Width Adjustment Bar, the Media-Length Adjustment Lever, and the Media-Size Bar. Normally, the operator will not change the media size.

Comprehensive media loading procedures may be found in the *4692 Operators Manual* and on the media tray. Proper media tray adjustments play a key role in the reliability of the media handling system.

Media-Width Adjustment Bar

NOTE

The following introduces the adjustments. Please go to "Loading Paper," or "Loading Transparency Film" in the operators manual when actually loading media.

This tray adjustment compensates for variations in media width and positions the media stack against the left edge of the tray. Sliding the adjustment bar forward and backward changes the width spacing. The adjustment bar should be set to the thickness of a small paper clip from the media stack. A too-tight adjustment may prevent the copier from loading media sheets.

Media-Length Adjustment Lever

This tray adjustment compensates for variations in media length and positions the media stack against the back of the tray. Tilt the tray toward the rear and lift the locking lever to permit the length adjustment bar to fall against the media stack. Return the lever to its locked position while insuring the media still lies flat. A too-tight adjustment may curl the media in the tray and prevent proper loading. A too-loose adjustment may result in the copier attempting to load two sheet of media instead of one.

Media-Size Bar

This tray adjustment provides a spacer that compensates for either A-size or A4-size media. For A-size media, the media-size bar is in the slot nearest the left edge of the tray. For A4-size media, the media-size bar is moved to the inside position slot.

CAUTION

If you change the position of the media-size bar, the drum assembly must be modified. The modification consists of changing the location of vacuum port covers on the drum assembly. Refer to the "Changing Media Size" procedure described in the operators manual.

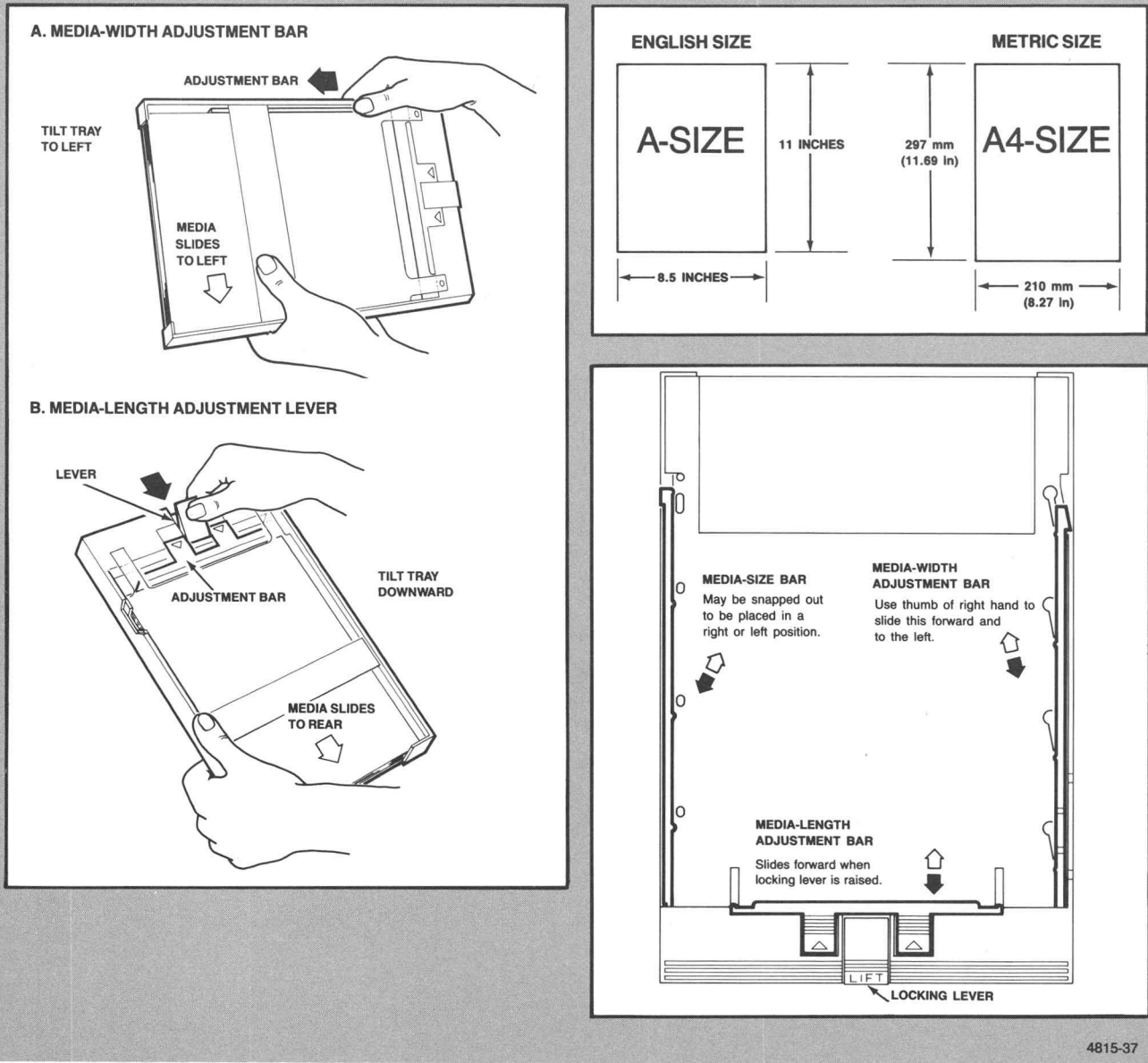


Figure 5-2 Media Input Tray Adjustments.

CHECKS AND ADJUSTMENTS

5.2.3 CARRIAGE DRIVE BELT TENSION

Adjust the tension of the head carriage drive if it is loosened or removed. This tension setting ensures smooth movement of the head carriage during imaging. See Figure 5-3.

1. Loosen the carriage drive belt pulley bracket on the left end of the drive belt.
2. Attach the scale as shown in Figure 5-3, and pull toward the left side of the copier.
3. When the scale shows 7 pounds (\pm one pound) of tension, hold this tension while tightening the bracket attaching screw.

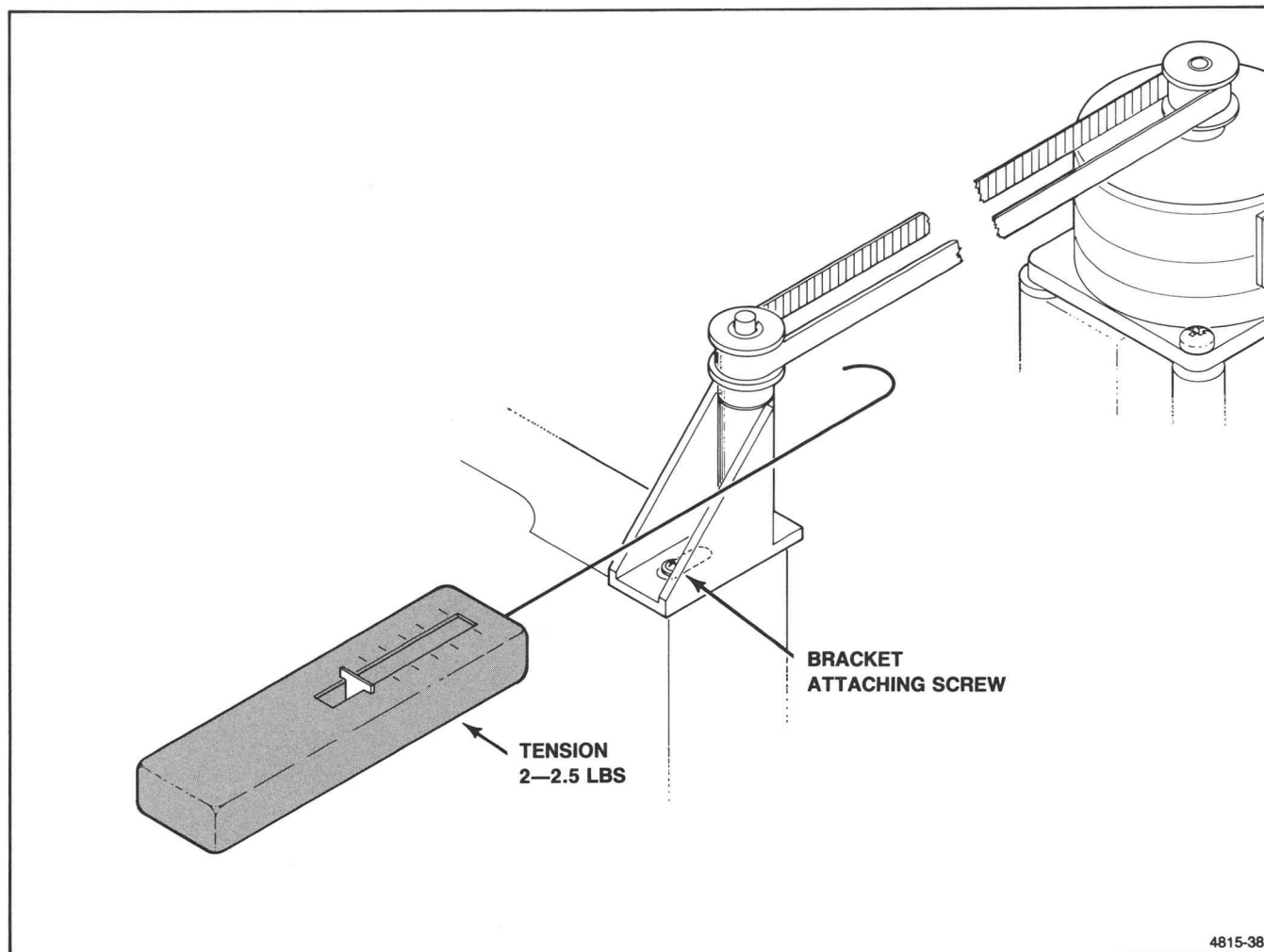


Figure 5-3. Carriage Drive Belt Tension Adjustment.

5.2.4 FLUFFER/MEDIA LOAD POSITION

The fluffer assembly not only provides ducting for air flow during media loading, but also contains two latches used to secure the media input tray. If the fluffer is removed, it is necessary to check and adjust its position to ensure predictable and reliable media loading.

1. Fill the media input tray with paper. To ensure proper alignment and adjustment, the media input tray should be loaded with 100 sheets ($\frac{3}{8}$ " stack).

NOTE

The capacity of the media input tray is 100 sheets of paper. Reliability of the media loading system may be adversely affected if this limit is exceeded.

2. Place a piece of paper on top of the ink cartridge assembly to keep the ejected copies from catching on protruding edges.

3. Place the copier in Service mode by:
 - a. Depressing the STOP COPY switch, press and release the TEST switch.
 - b. Release STOP COPY, and observe that the READY and FAULT indicators are flashing.

Once in Service mode, when the TEST switch is pressed, the PORT indicators will cycle in sequence (Port 1 to Port 4). Each lit Port represents a different test sequence.

HINT — If you miss your Port, don't dismay, and don't release the switch. It'll come around again! Just wait until all four ports have lit, and then Port 1 will light again.

4. Press and hold the TEST switch until Port 3 is lit then release the switch. This initiates the media load cycle. Once the media is loaded, the drum stops.
5. Rotate the drum by hand until you can check the position of the leading edge of the media. See Figure 5-4. The gap between the leading edge of the media and the step on the drum should be even and approximately .020". The gap slowly widens as the media input tray empties (the maximum gap — when the tray is almost empty — is .050").

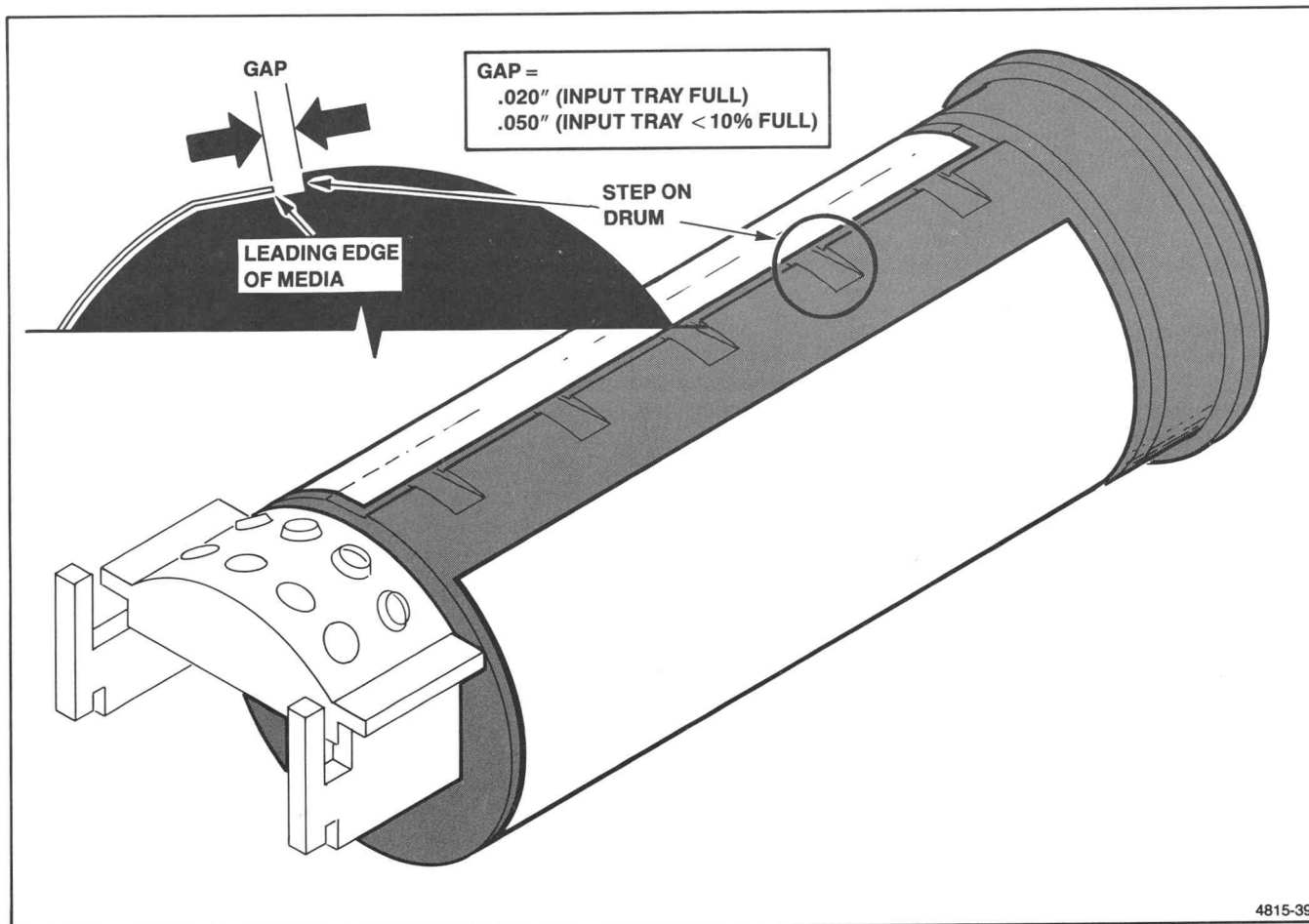


Figure 5-4. Checking Media Position on the Drum.

6. If adjustment is necessary, the head carriage must be moved manually to access the left fluffer attaching screw. Loosen the fluffer attaching screws shown in Figure 5-5a. Grasp the front of the media input tray and move it in accordance with the illustration.

From this point, there are four possibilities:

- a. **If the paper alignment and gap are correct**, press STOP COPY to unload the paper, then press CLEAR to return the copier to Normal mode.
- b. **If the gap is too wide**, loosen the two screws shown in Figure 5-5a, move the fluffer assembly toward the rear of the copier, and tighten the screws. Press the PURGE switch. This will unload the paper on the drum and repeat the media load cycle. Check the gap for correct spacing (.020").
- c. **If the gap is too narrow**, loosen the two screws shown in Figure 5-5a, move the fluffer assembly toward the front of the copier, and tighten the screws. Press the PURGE switch. This will unload the paper on the drum and repeat the media load cycle. Check the gap for correct spacing (.020").
- d. **If the gap is uneven**, check the media tray alignment. See Figure 5-5b.

NOTE

The grooves on the front top edge of the media input tray (by the Media-Length Adjustment locking lever) provide a visual reference for this alignment procedure. Check the alignment of the tray before removing it.

7. When the fluffer adjustment/media loading is complete and correct, press STOP COPY and then CLEAR to return the copier to Normal mode.

NOTE

Ensure that the fluffer mounting screws are tight.

CHECKS AND ADJUSTMENTS

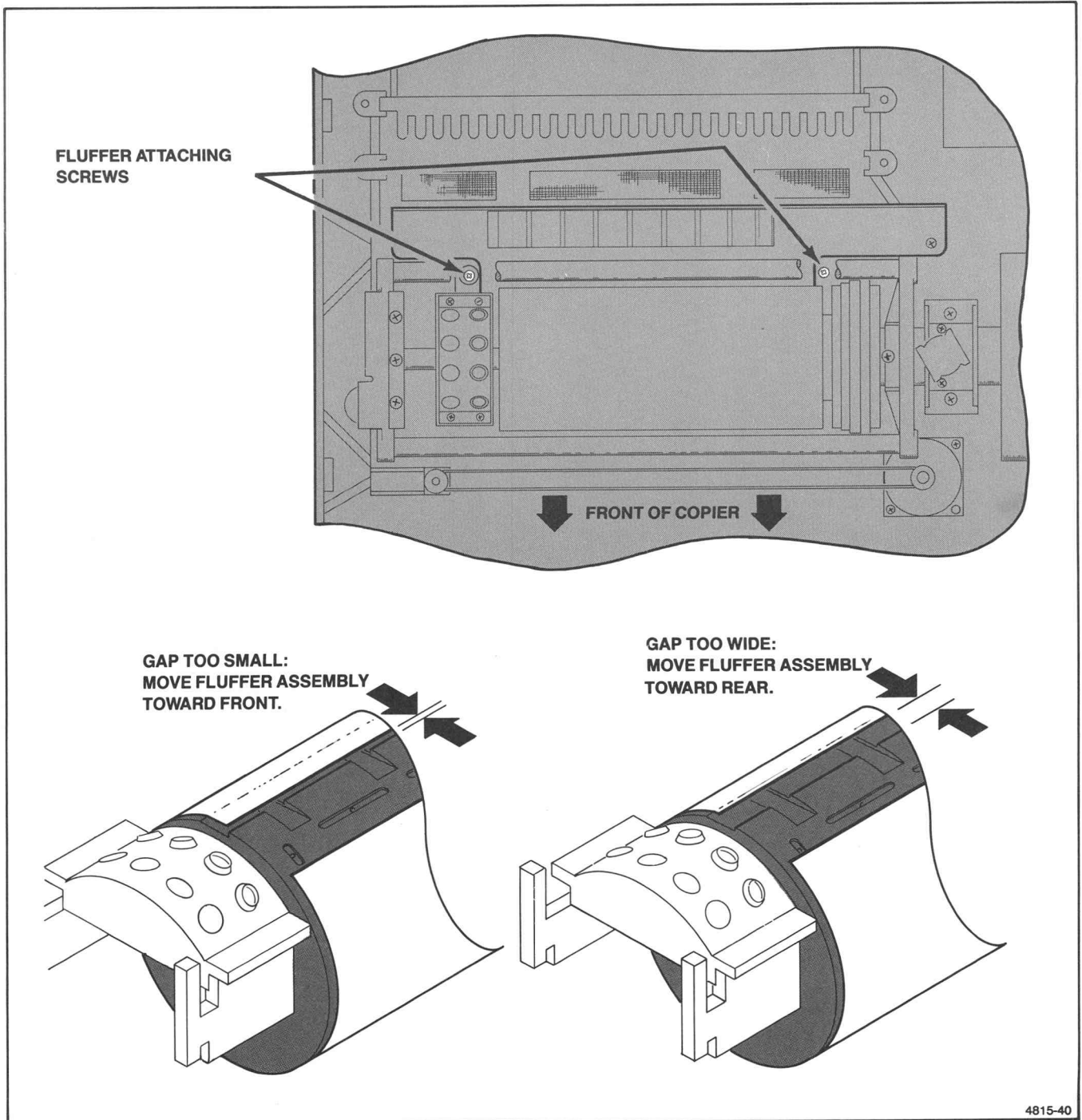


Figure 5-5a. Fluffer/Media Loading Adjustment.

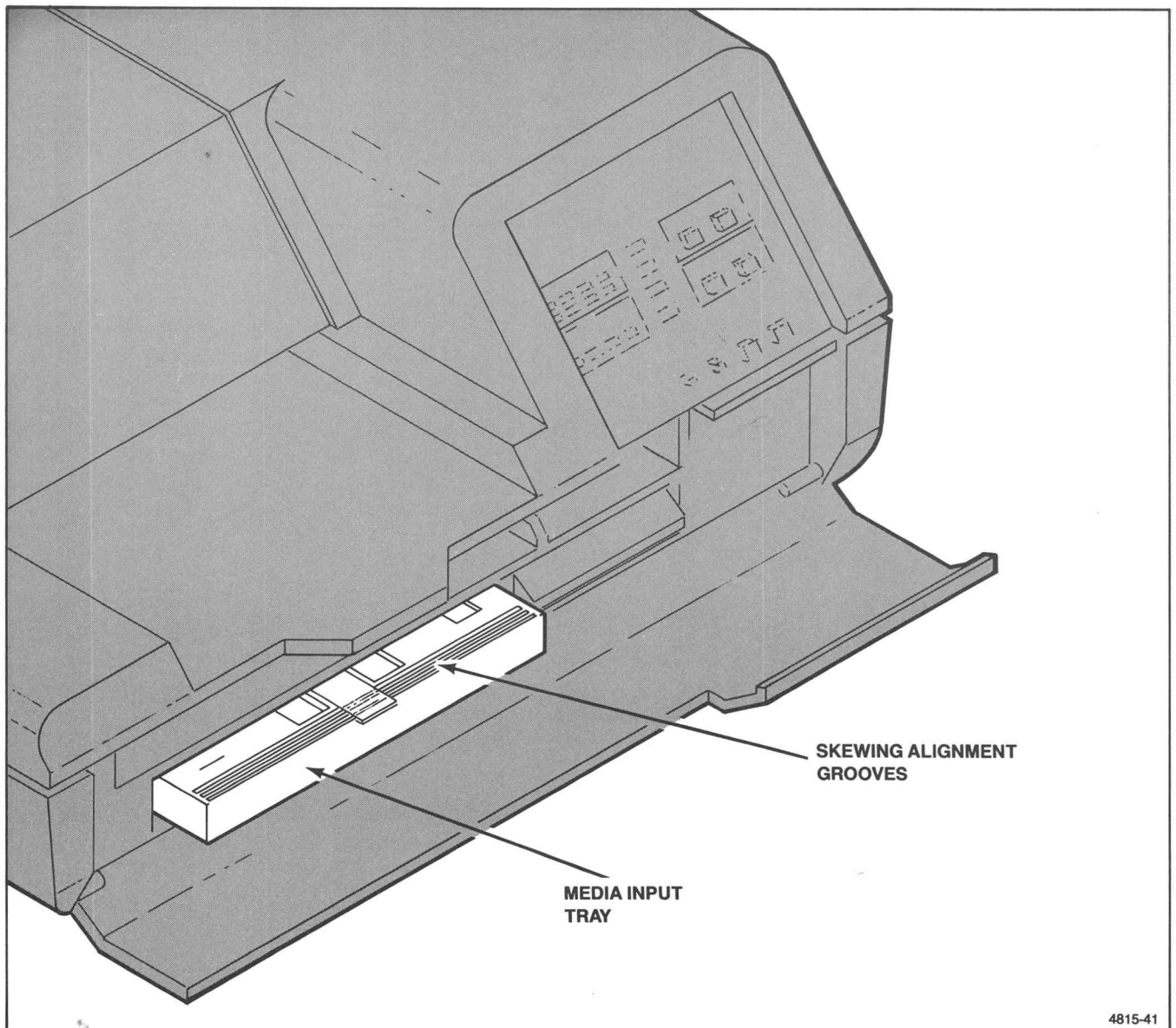


Figure 5-5b. Media Tray Alignment.

5.2.5 HEAD MAINTENANCE STATION TENSION

The head maintenance station serves two major functions. The *head-cap position*, to the left, seals the ink-jet heads whenever you power-down the copier. The *head-wash position* fulfills two purposes. They are:

- The ink-jet heads are “parked” at the wash position “wash cups” when the copier is powered-on, but not producing a copy to prevent drying out and contamination of the ink-jet heads.
- The wash cups are also part of the head wash and head purge system. Whenever either wash or purge cycles are initiated, the waste fluid must be directed through the wash cups to the waste portion of the maintenance cartridge. If the wash cups do not seal properly, the waste fluid can create a mess inside the copier.

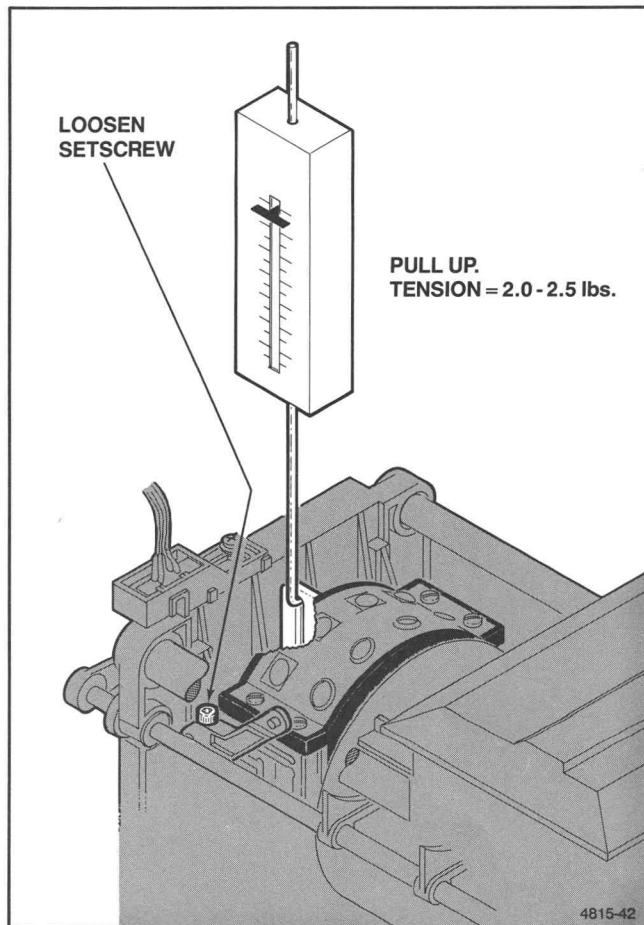


Figure 5-6. Head Maintenance Station Tension Adjustment.

To ensure that the head maintenance station properly seals the ink-jet heads during storage or maintenance operations, the maintenance station is tensioned against the ink-jet heads. This procedure details how to set the maintenance station tension and check for proper sealing — see Figure 5-6.

If you are setting the head maintenance station tension **after just replacing the head maintenance station, you should perform the following before performing Step 1.**

Manually position the head carriage over the head wash position of the head maintenance station. Ensure the head maintenance station's arm correctly mates with the cam slot of the head carriage bearing. The head carriage is correctly positioned over the head-wash position when the interruptor (left and of the head carriage bearing) is even with the left edge of the opto-sensor — see Figure 5-6.

1. Power-up the copier and place the copier in Service mode by:
 - a. While depressing the STOP COPY switch, press and release the TEST switch.
 - b. Release the STOP COPY switch, and observe that the READY and FAULT indicators are flashing.

CAUTION

After replacing the head maintenance station, it may be far enough out of adjustment that the ink-jet heads may “wash” into the head maintenance station during the power-up routine.

Once in Service mode, when the TEST switch is pressed, the PORT indicators will cycle in sequence (Port 1 to Port 4). Each lit Port represents a different test sequence.

2. Press and hold the TEST switch until Port 2 is lit and then release the switch. This starts the head wash routine (Service Test 2) and automatically positions the ink-jet heads over the wash position of the head maintenance station. *1 Press PURGE to turn off the air to the ink-jet heads.*
3. Loosen the cam arm set screw with a 7/64" Allen wrench. Leave the Allen wrench in place for the next step.

NOTE

When setting the maintenance station tension, DO NOT set it too tight. The caps may be damaged or deformed by excessive pressure. The results could be leakage or the heads "crashing" into the caps when returning from imaging.

4. Attach a spring scale through the slot in the bracket on the left side of the maintenance station — see Figure 5-6.
5. While pulling upward with a steady force of 2 to 2.5 pounds, retighten the 7/64" Allen screw on the cam arm.
6. Test the action of the maintenance station cam by moving the head carriage right, then back to the maintenance station. If the motion of the carriage is severely restricted by the maintenance station, it is adjusted too tight. Readjust using a lower tension on the spring scale. The minimum tension equals two pounds.

NOTE

As you would surmise, the maintenance station can leak if the seal contact is too loose (caps not mating with heads), but it can also leak if it is too tight (caps deflected too much). Check performance with several wash cycles (pressing PURGE while in the Head Wash routine) before concluding the seal pressure is correct.

7. Move the carriage by hand (by pulling on the carriage drive belt) toward the middle of the carriage rails and back to the wash position. An increase in drag should be felt when the head carriage engages the maintenance station because of the pressure of the wash cup seals. If this tension is excessive, it may stall the carriage motor or cause the carriage drive belt to skip.
8. If the tension is O.K., then press STOP COPY to exit the Service test and then press CLEAR to exit Service mode.

If any leakage is detected, repeat this procedure. If the leakage continues, recheck the tension adjustment and ink-jet head to head maintenance station alignment. Replace the head maintenance station if any cups continue to leak — refer to Section 6.4.3 "Head Maintenance System."

7a. Press STOPCOPY. Then press and hold TEST until Port 2 is lit, ~~then~~ release TEST. Check seal performance with several wash cycles (pressing PURGE while in Test 2) to confirm proper sealing.

5.2.6 ANGLE BRACKET TO DRUM POSITION

The position of the “service loop angle bracket” in relation to the drum is important. The angle bracket must be close enough to “wipe” the media onto the drum during loading and yet far enough away to ensure that it doesn’t interfere with the media on the drum during imaging. If this part is removed, the position must be checked and adjusted — see Figure 5-7.

1. Loosen the three screws retaining the angle bracket.
2. Place a .060” thickness gauge between the drum and the angle bracket and adjust the spacing.
3. Check that the spacing is even.
4. Tighten the screws.

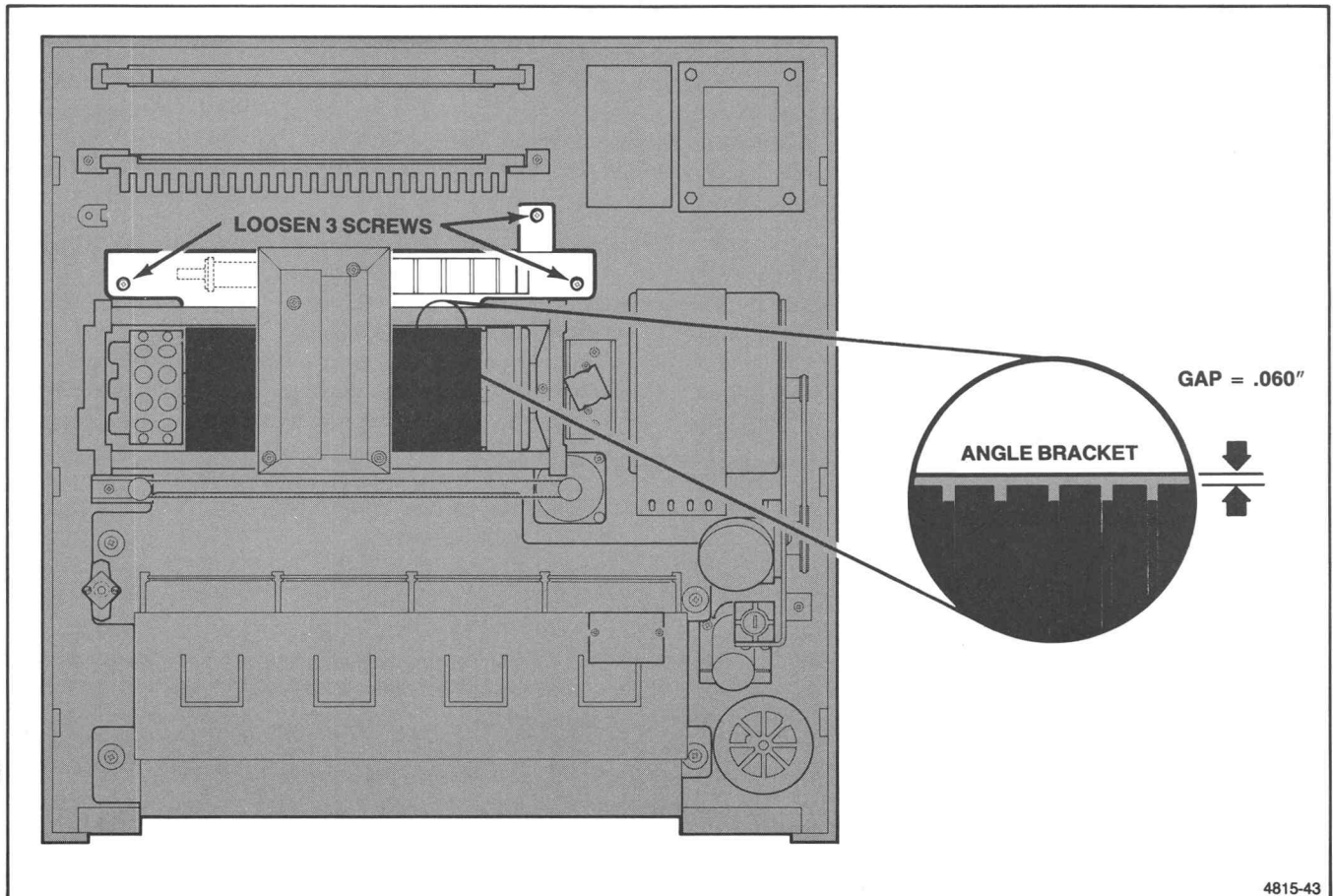


Figure 5-7. Angle Bracket to Drum Position Adjustment.

5.3 ELECTRICAL CHECKS AND ADJUSTMENTS

5.3.1 CHECK INPUT POWER REQUIREMENTS

1. Check the voltage setting and fuse on the rear panel. See Figure 5-8 for the line voltage selector and fuse location, and Table 5-1 for the fusing requirements.

Table 5-1
FUSING REQUIREMENTS

Option	Line Voltage	Fuse
52	100 typical	3.2A SB
STD	120	3.2A SB
A1	220	1.6A SB
A2	240	1.6A SB
A3	240	1.6A SB
A4	240	1.6A SB
A5	220	1.6A SB

2. Connect the power cord to the proper voltage outlet and the copier. Use a variable transformer (variac) with a wattmeter if available.
3. Connect the copier power cord to the transformer. With the copier turned off, turn up the variac to operating voltage. There will be a small current draw while the copier is "off" since the +28 volt supply is active. A large current draw indicates a problem with the +28 volt supply or one of the circuits it supplies.

When the copier is turned ON, it will have an initial surge of less than 300 watts. The largest surge will occur while the blower motor comes up to speed. When the power-up sequence is complete, the power consumption should be about 35 watts.

4. While the copier performs the power-up sequence, you should observe that:
 - a. POWER light turns ON.
 - b. READY light starts blinking.
 - c. Head carriage moves to the wash position and stops.
 - d. MAINT light turns ON — READY light turns OFF.
 - e. Blower motor runs then stops.
 - f. Wash pump runs, performs a wash cycle and stops.
 - g. MAINT light turns OFF.
 - h. READY light turns ON.

If a FAULT occurs (the FAULT indicator lit), press the TEST switch, and observe the Extended Error Code displayed using the INK LOW and PORT light. Appendix J lists the error codes.

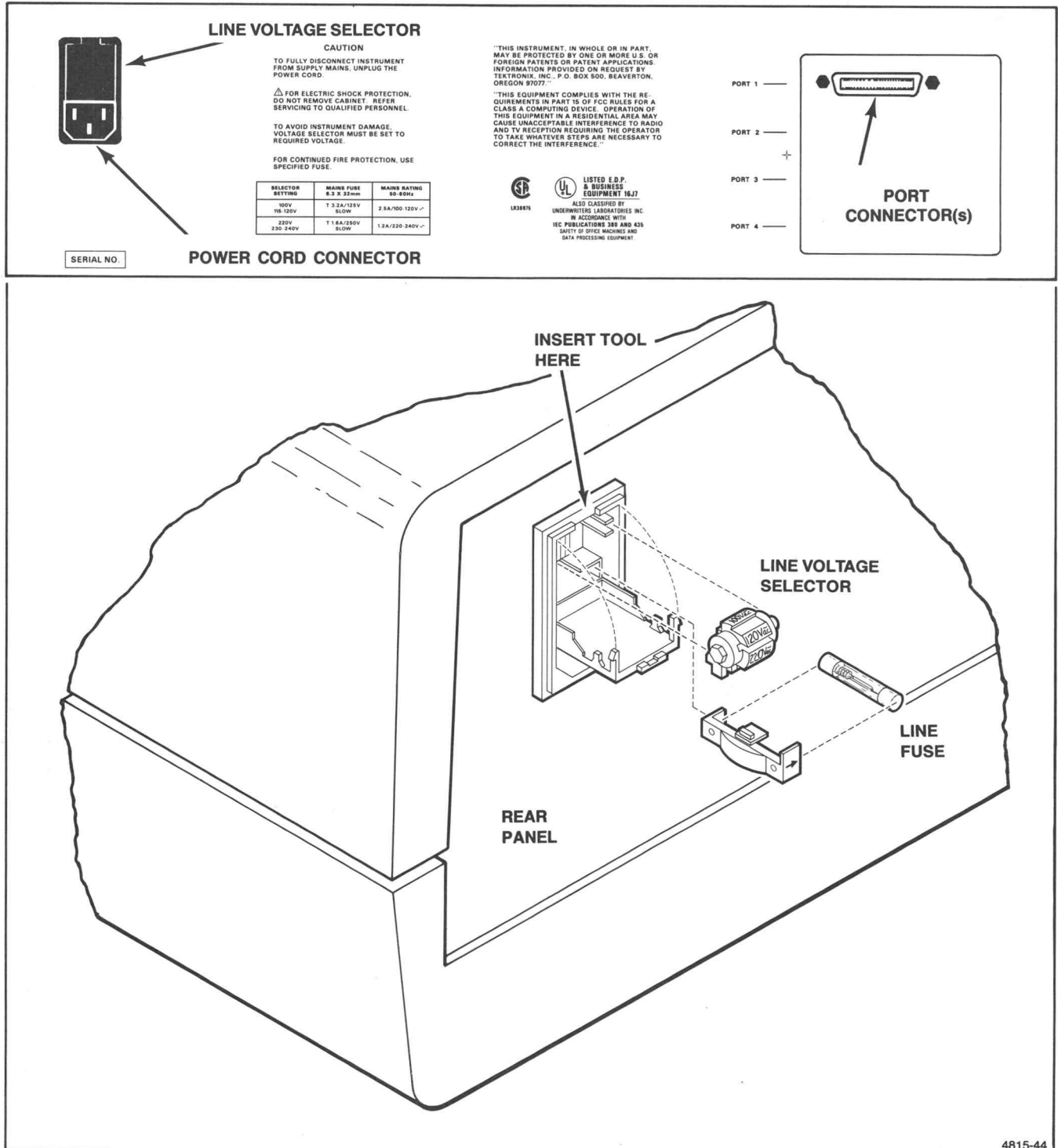


Figure 5-8. Line Fuse and Voltage Selector Location.

CHECKS AND ADJUSTMENTS

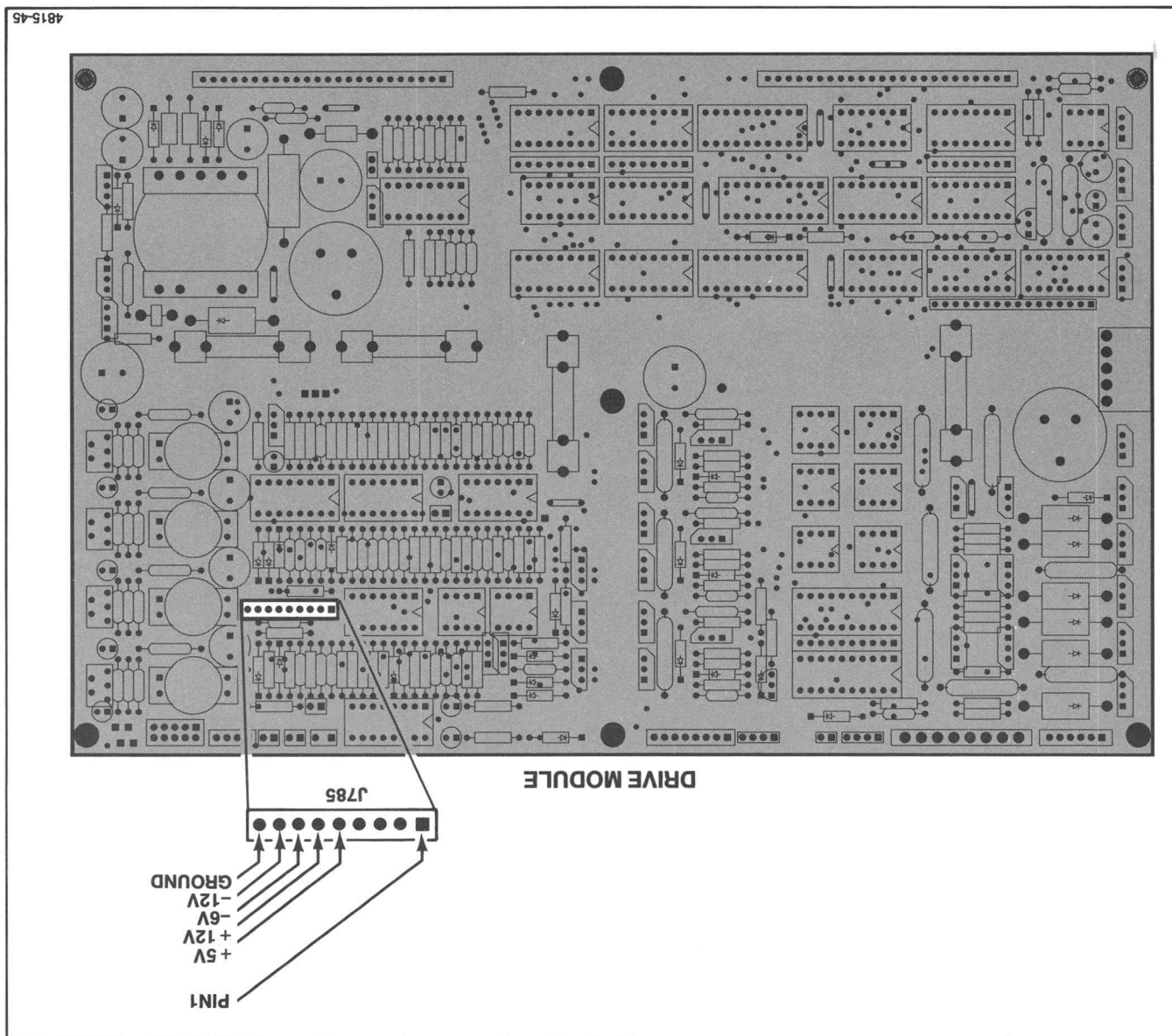
5.3.2 POWER SUPPLY CHECKS

Figure 5-9 shows the location of the power supply test points on the Drive Module board. Table 5-2 shows the operating range of these supplies.

Table 5-2
POWER SUPPLY CHECKS

Supply Voltage	Range (Volts)	Test Point
+ 5 volts	4.9 to 5.1	J785 pin 5
+ 12 volts	11.4 to 12.6	J785 pin 6
-6v (-6.4 nom)	-5.6 to -7.2	J785 pin 7
-12 volts	-11.4 to -12.6	J785 pin 8
+ 28 volts (unreg.) Hiline (min. load) Loline (max. load)	+ 36 + 22	J9 pin 1 to pin 3
Ground reference	—	J785 pin 9

Figure 5-9. Power Supply Test Points.



5.3.3 INK-JET HEAD VOLTAGE ADJUSTMENT

WARNING

This procedure involves potentially harmful voltages. Extreme care must be taken when connecting the scope probe to or removing it from the ink-jet head voltage test points.

1. Locate the head voltage test points on the Drive Module. See Figure 5-10.
2. Set the oscilloscope to measure a 200 volt (peak to peak), 20KHz sinewave.

VOLTS/DIVISION = 50
SWEEP = 50 μ /division
3. Place the copier in Service mode by:
 - a. Holding the STOP COPY switch in, press and release the TEST switch.
 - b. Release the STOP COPY switch and observe that the READY and FAULT lights flash simultaneously. The copier is now in Service mode.
 - c. Depress and hold the TEST switch until the PORT 4 light (representing Ink-jet Head Voltage Adjustment test) illuminates. When activated, this test moves the ink-jet heads over the wash position, pressurizes the ink and air systems, and energizes the ink-jet head amplifiers.

NOTE

To prevent the copier from being left in this mode, and unintentionally depleting the ink supply, this test automatically terminates after one minute.

The values you set during the test are translated by the Process Control board during actual imaging to drive the Cyan, Magenta, and Yellow ink-jet heads at 192 volts p/p and the Black ink-jet head at 220 volts p/p.

RECOMMENDATION: Since most scopes have a tolerance of $\pm 3\%$ (at best), we suggest that you use a true R.M.S. meter, with frequency range of 100 kHz, whenever available, to provide accurate adjustment.

4. Connect a 10X probe to each of the test points shown in Figure 5-10 while adjusting the appropriate pot for the proper drive voltage. The yellow, cyan and magenta ink-jet heads setting is 185 volts p/p (65.4 volts RMS) while the black ink-jet head setting is 196 volts p/p (69.3 volts RMS).
5. Press STOP COPY to exit the head drive voltage test routine when you complete the adjustments. Then press CLEAR to exit Service mode and return to Normal mode. The READY light should come turn on.
6. Remove the 10X probe.

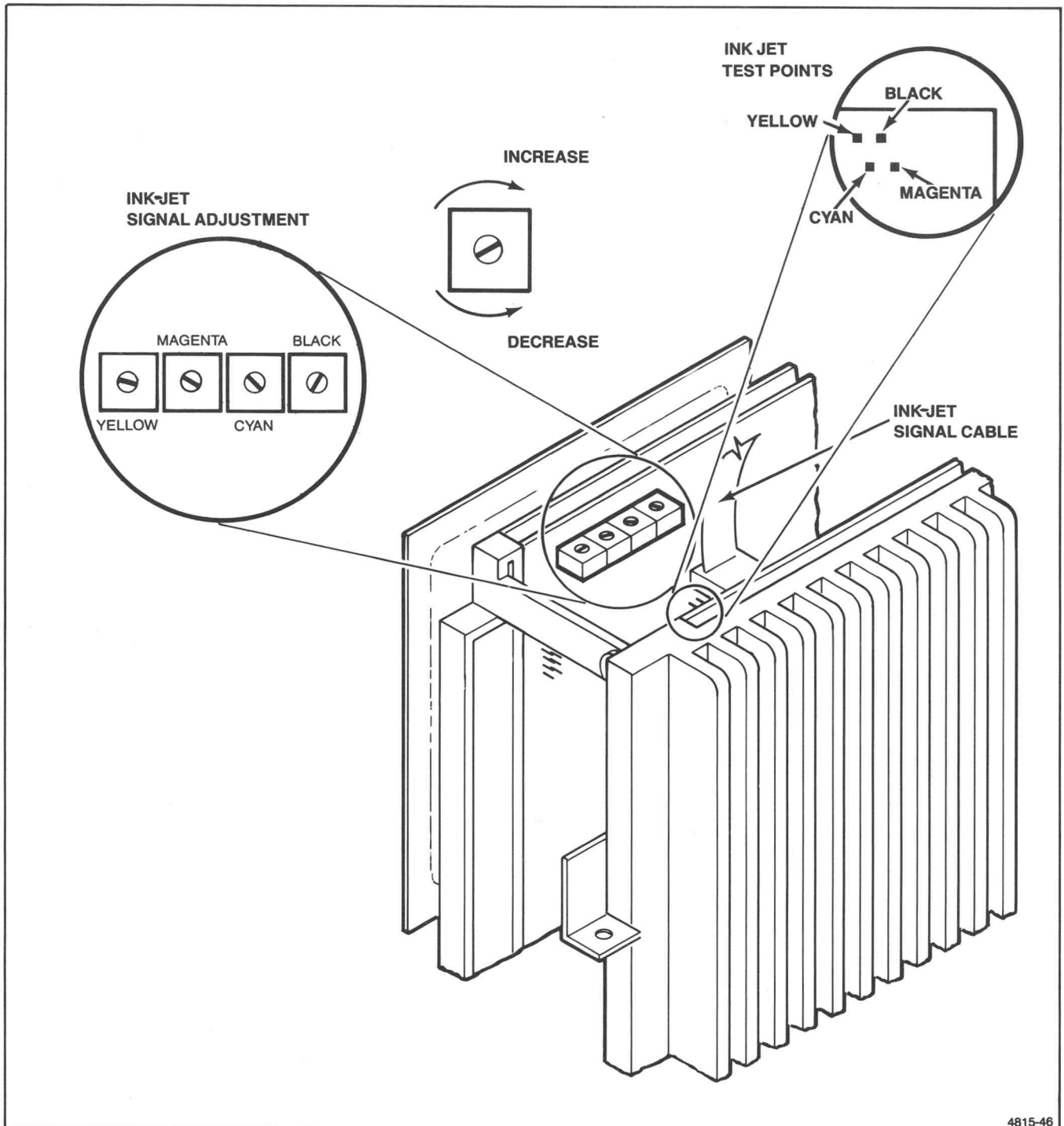


Figure 5-10. Ink-jet Head Voltage Test Points and Adjustments.

5.4 IMAGING (INK-JET) CHECKS

After operating voltages for the ink-jet heads have been set, the density performance (TEST pattern 2: solid fill), and frequency response (TEST pattern 4: frequency) can be checked, the head alignment (TEST pattern 3: convergence) can be checked and adjusted. The internal test patterns available in TEST mode are used for these checks and adjustments.

5.4.1 CHECKING INK-JET HEAD PERFORMANCE

This procedure uses the copier's internal test patterns to check the ink-jet heads performance. If trouble is detected, the T.V. (Threshold Voltage) Pattern Generator Test Fixture should be used to troubleshoot the problem. You do not have to remove the top cover to operate these tests.

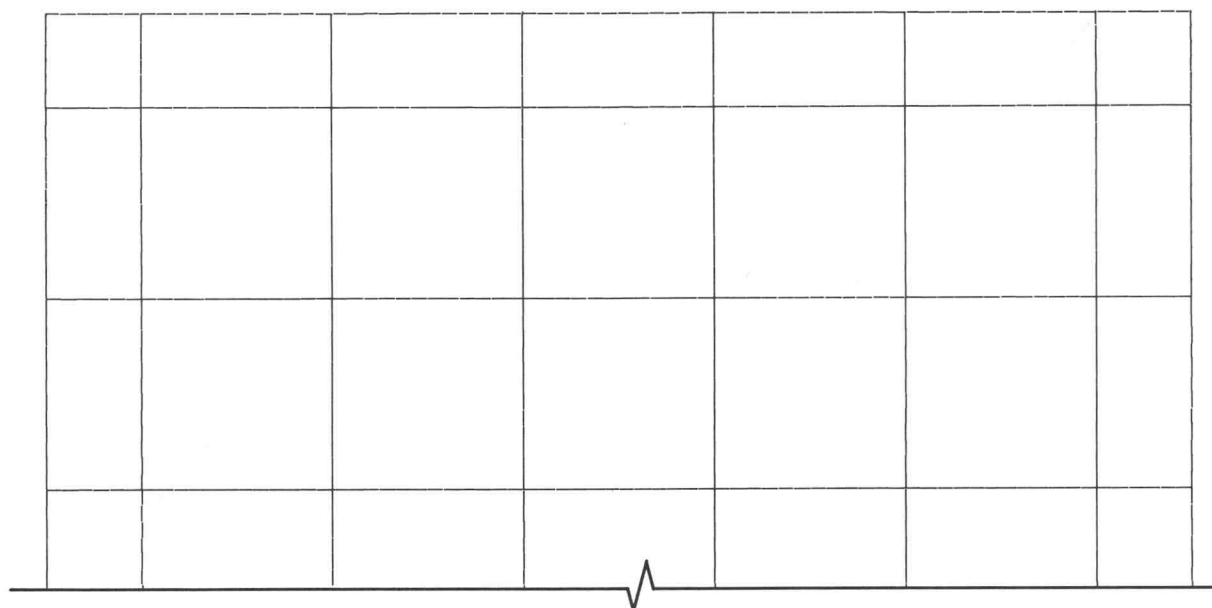
1. Enter TEST mode by pressing and holding the TEST switch until the port lamp representing the desired test illuminates. When you release the switch to select and start the test, the port lights will "invert" — the selected test lamp will turn off and the other three port lights will turn on.
2. Run all four test patterns, and check for irregularities. You should look for:
 - a. TEST 1 (STRIPES): Ensures that the ink-jet heads turn on and off at the proper time. Check for consistent spacing on the long axis of the copy, straight edges between each band of color and extra printing between the bars. Some degree of fine spray or fringe marks on the trailing edge of the bars is normal. Spurious marks equal to or greater in size than the line width in the convergence pattern are not acceptable.
 - b. TEST 2 (SOLID FILL): Check that each color appears solid without any streaks, voids, or large variations in density.

- c. TEST 3 (CONVERGENCE): This test provides a picture of the alignment of the four heads. Figure 5-11 shows the convergence test pattern. Check that none of the individual colors are displaced from the black reference by more than a full line width. If adjustment is required, refer to the instructions that follow.
- d. TEST 4 (FREQUENCY): This test exercises each head at eight different frequencies. This test pattern is the most sensitive to variations in ink-jet head performance. Some variation is normal. One or two of the first four bands printed for each color may show irregularities. If more than two bands of a given color show significant irregularities, that ink-jet head is not performing as it should.

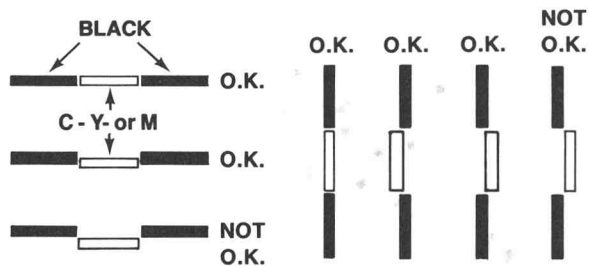
Refer to troubleshooting notes, section xx for a description of what is considered irregular performance.

Convergence Checks

1. Press and hold the TEST switch until the Port 3 indicator is lit and release the switch.
2. The resulting copy will be a convergence test pattern — see Figure 5-11.
3. Visually check:
 - a. Overall line straightness. The edge of any line should not exhibit any short term deviation greater than .005".
 - b. Vertical line alignment. The specifications require that the lines for each ink-jet head will not deviate more than one line width from the black reference line.
 - c. Horizontal line alignment. The specifications require that the lines for each ink-jet head will not deviate more than one line width from the black reference head.



CONVERGENCE TEST PATTERN
(Partial)



NOTE

- Color ink lines should be no more than *one line width* out of line.
- Check CYAN, MAGENTA, and YELLOW on all areas of the copy.

4815-47

Figure 5-11. Ink-Jet Head Convergence Checks.

CHECKS AND ADJUSTMENTS

Convergence Adjustment

If the checks in the previous procedure indicates the ink-jet heads are not properly converged, follow these steps to correct the problem. The BLACK head is the reference head and therefore isn't adjustable. Each of the other ink-jet heads have two adjusting screws. Figure 5-12 shows the location of the adjusting screws, and Table 5-3 shows the effect on line (both horizontal and vertical) position. Figure 5-13 shows the effects of adjusting each head in reference to Table 5-3.

1. Power-down the copier and remove the top cover — see Section 6.2.1 "Top Cover."
2. Remove the head carriage cover and then power-up the copier.
3. Use a 7/16" Allen wrench to loosen the ink-jet head mounting screw of the ink-jet head to be adjusted.
4. Use a 1/4" nut driver to turn the adjusting screws of the head to be adjusted. Table 5-3 and Figure 5-13 show the effect of turning these adjusting screws.
3. Tighten the ink-jet holding screw.
4. After each adjustment, run a copy to verify the results. Pressing STOP COPY allows you to receive a partial copy with enough printing to verify convergence. Repeat this procedure for each ink-jet head until all are converged.

See Change info

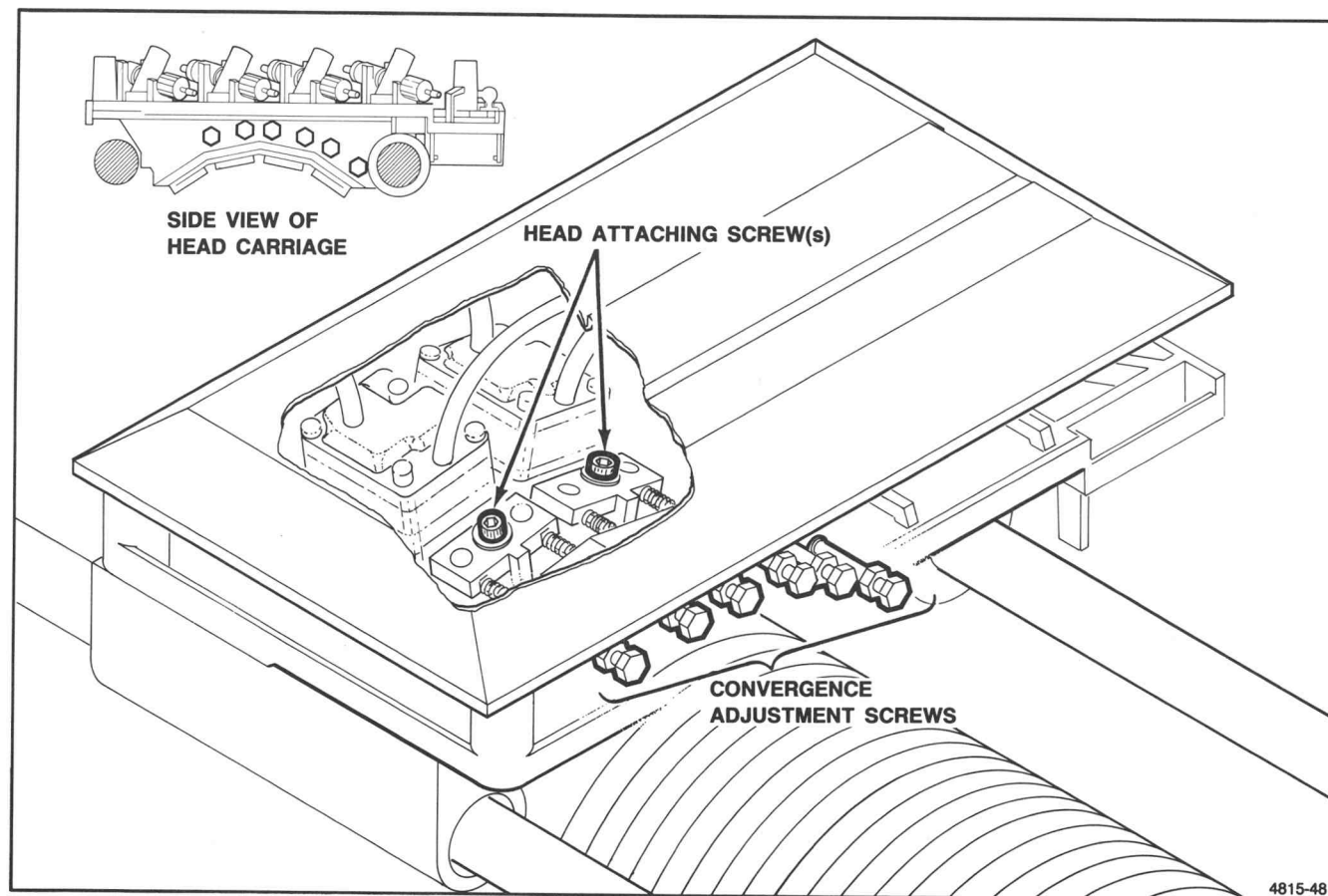


Figure 5-12. Location of Convergence Adjustments.

CHECKS AND ADJUSTMENTS

Table 5-3
EFFECTS OF HEAD ADJUSTMENTS

Line Adjusted	Turns	Direction ^a	Inches = Line Width
Horizontal	1/6	same	.003" 1/2 line
Horizontal	1/3	same	.006" 3/4 line
Horizontal	1/2	same	.009" 1 line
Horizontal	1.0	same	.018" 2 lines
Vertical	1/6	opposite	.007" 3/4 line
Vertical	1/3	opposite	.015" 1.0 lines
Vertical	1/2	opposite	.022" 2.0 lines
Vertical	1.0	opposite	.044" 3.8 lines

^a When using this table, the direction column indicates which way the two adjusting screws, for an ink-jet head, are turned in relation to each other. When the screws are turned CW (clockwise) the ink-jet heads move to the right and CCW (counter-clockwise) moves them to the left. Moving the screws in opposite directions moves the ink-jet heads either up or down. Refer to Figure 5-13.

5.5 POWER-DOWN CHECK

After the copier has been checked out, the power down sequence should be observed. Press the POWER OFF switch and check to see:

1. The READY indicator turns off.
2. The POWER indicator starts flashing.
3. The blower motor turns on.
4. Head carriage moves to the left (to the head-cap position).
5. Blower motor stops.
6. POWER indicator turns off.

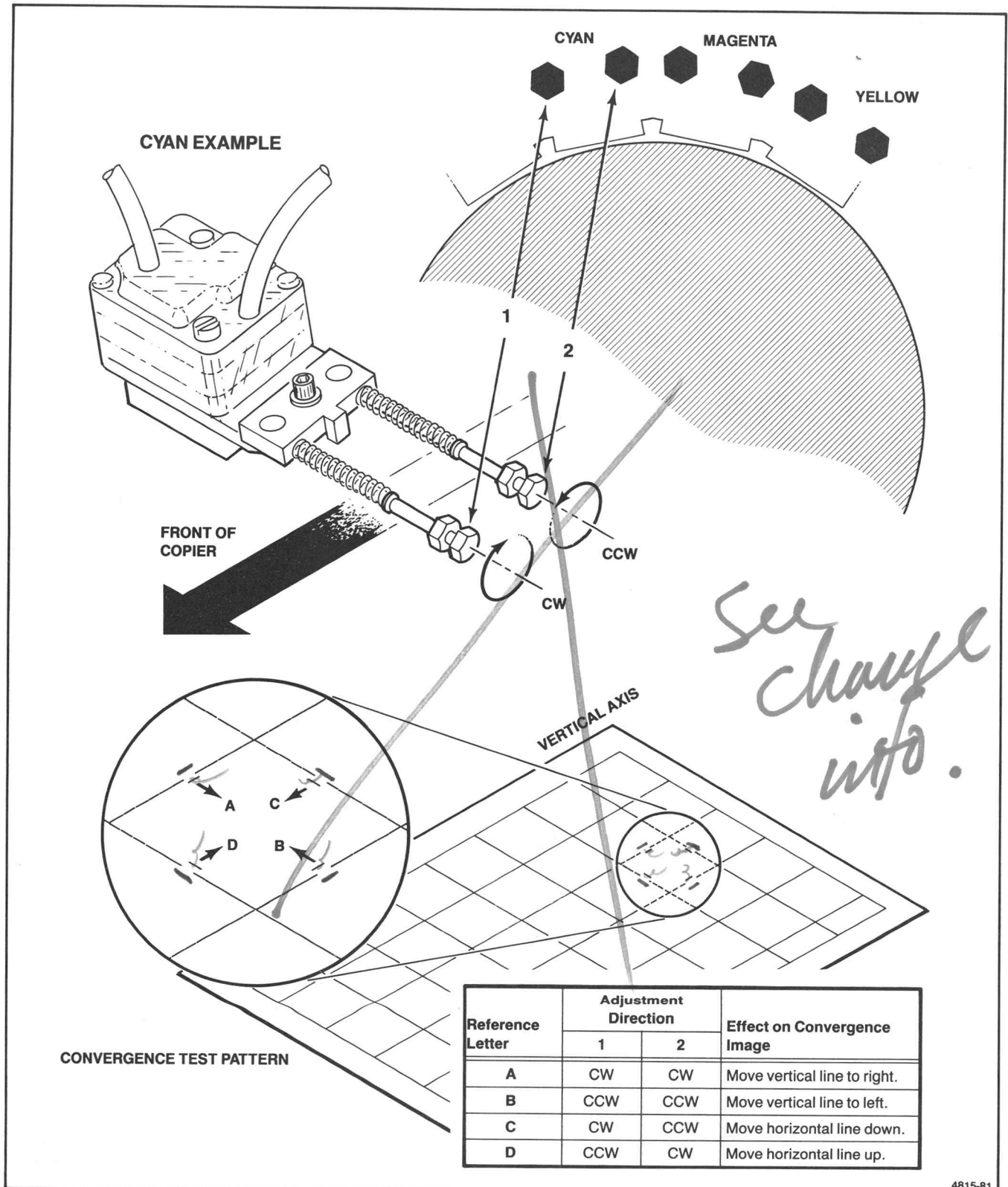
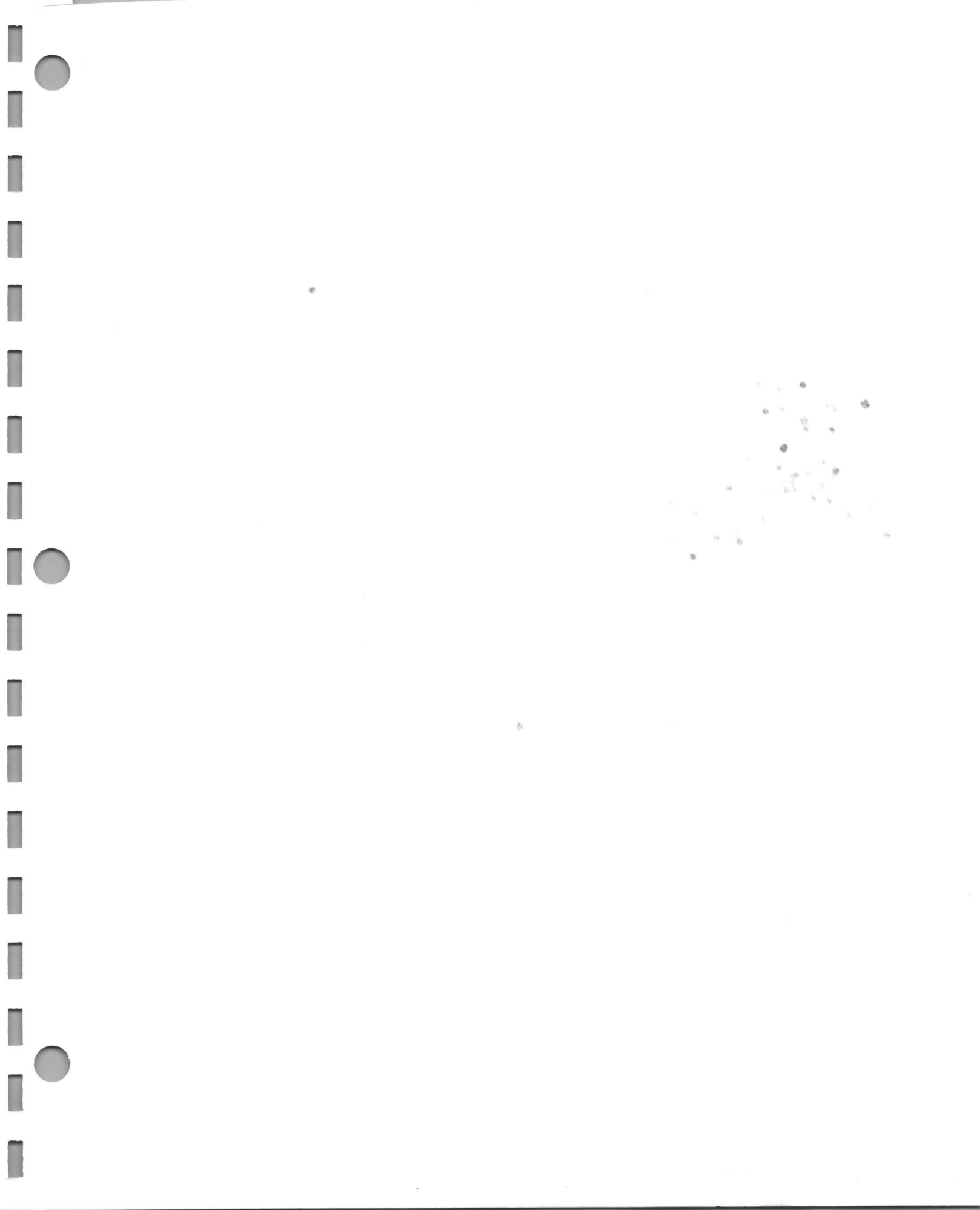


Figure 5-13. Convergence Adjustments.



Section 6

MECHANICAL DISASSEMBLY/ASSEMBLY

6.1 INTRODUCTION

This section provides an ordered approach for removing and replacing the copier's assemblies. If you require supplementary information, Tektronix produces a training video tape providing step by step procedures to accomplish the tasks described in this section. This tape may be ordered through your local Tektronix Field Office.

When you perform any procedure that requires handling the ink-jet heads, ink delivery system, or associated ink handling components, **handle with care**. Shock or contamination can permanently damage ink-jet heads.

6.1.1 WARNING SUMMARY

Read and understand these warnings before attempting to disassemble or repair the copier.

WARNING

Never remove power from the copier by disconnecting the power cord. Press the POWER OFF switch and allow the copier to perform the power-down sequence before removing the power cord from the rear panel. This allows the copier to perform a maintenance cycle to protect the ink-jet heads.

The information contained in this manual is for experienced service technicians ONLY. DO NOT attempt to repair this copier unless you are familiar with the necessary precautions for working around the high voltage ink-jet head system. Failure to heed this warning could injure you or damage the copier!

The air pump drive shaft features a counterweight to balance the cam action of the air pump drive. While spinning around, the counterweight is very difficult to see and could cause injury if contacted! Also beware of the air pump's rotating drive belt and pulleys when in operation.

6.1.2 REQUIRED TOOLS

Table 6-1 lists the tools required to service the color copier.

Table 6-1
REQUIRED TOOLS

Part Number	Description
003-0762-00	15 lb. push/pull spring scale
006-6219-00	0 - 50 (inches of water) pressure gauge
118-2872-00	Air/ink line clamps (minimum of 4)
003-0173-00	Nutdriver set. 3/32" through 3/8" (minimum set = 1/4, 5/16, 3/8, & 7/16)
003-0293-00	Magnetized screwdriver handle for interchangeable tips
003-0602-00	Screwdriver tip (size = #1)
003-0603-00	Screwdriver tip (size = #2)
003-0192-00	Flat screwdriver for #2 & #4 screws
003-0514-00	Flat screwdriver for #6 screws
003-0422-00	Phillips screwdriver for #2 screws
003-0089-00	1/16" Allen driver with handle
003-0090-00	5/64" Allen driver with handle
003-0075-00	7/64" Allen driver with handle
003-0236-00	Tweezers
003-0048-00	Gripping screwdriver

Miscellaneous Supplies

A service toolkit should include a supply of lint-free, disposable tissues (like Kimwipes®), a supply of distilled water, and a six ounce plastic squeeze bottle with spout, and a small waste container (to catch purged ink).

6.1.3 CONTENTS OF THIS SECTION

The major assemblies addressed in this section are listed below in the order of removal.

- Top Cover
- Electronic Circuit Boards – Parallel Interface – Process Control – Drive Module
- Wet Section
 - Ink-jet head assembly
 - Service loop
 - Ink cartridge assembly
- Head Maintenance System
 - Head Maintenance Station
 - Head Wash Pump
 - Fluid lines and service loop mounting bracket
 - In-line filter
- Print Engine Assembly
 - Carriage Rails
 - Stripper
 - Stripper Solenoid
- Drum/Drum Motor Assembly
- Blower Motor
- Fluffer Assembly
- Regulated Air System
 - Air Pump
 - Regulator
 - Air Valve
 - Accumulator
- Input Power System
 - Transformer
 - Line Voltage Selector and Line Fuse
 - Bridge Rectifier
 - Secondary filter capacitor (+ 28 volts)

See change info.

6.2 GAINING ACCESS TO THE COPIER ASSEMBLIES

The top cover must be removed any time the electrical or mechanical assemblies must be serviced, repaired, or replaced.

6.2.1 TOP COVER

The name “top cover” refers to the upper half of the copier’s cabinet. The cabinet design allows easy removal of the cover and unrestricted access to the major assemblies.

Removal/Replacement

1. Press the POWER OFF switch. When the copier completes the power-down sequence (POWER light off), disconnect the power cord from the rear panel. Remove the media output tray.
2. Remove the three screws across the top of the rear panel. See Figure 6-1 for the location of these screws.
3. Return to the front of the copier and open the consumables access door.
4. Remove the two screws from the front mounting brackets. See Figure 6-1 for their location.
5. Lift the top cover until the front attaching brackets clear the cabinet bottom. Slide the cover forward about two and a half inches until the back of the media exit ramp clears the head carriage drive belt. The top cover is now in position to disconnect the top door switch and remove the front panel.
6. Remove the top access door from the top cover, and disconnect the door switch cable — see Figure 6-2.
7. Detach the front panel from the top cover. The front panel mounts on two banana pins, and must be carefully pulled down. Once detached, allow the front panel to rest on the front access door. DO NOT attempt to detach the front panel from the copier.
8. Remove the top cover by lifting it straight up and off the copier. Ensure the rear of the media exit ramp clears the carriage drive belt.
10. Reverse these steps to replace the top cover.

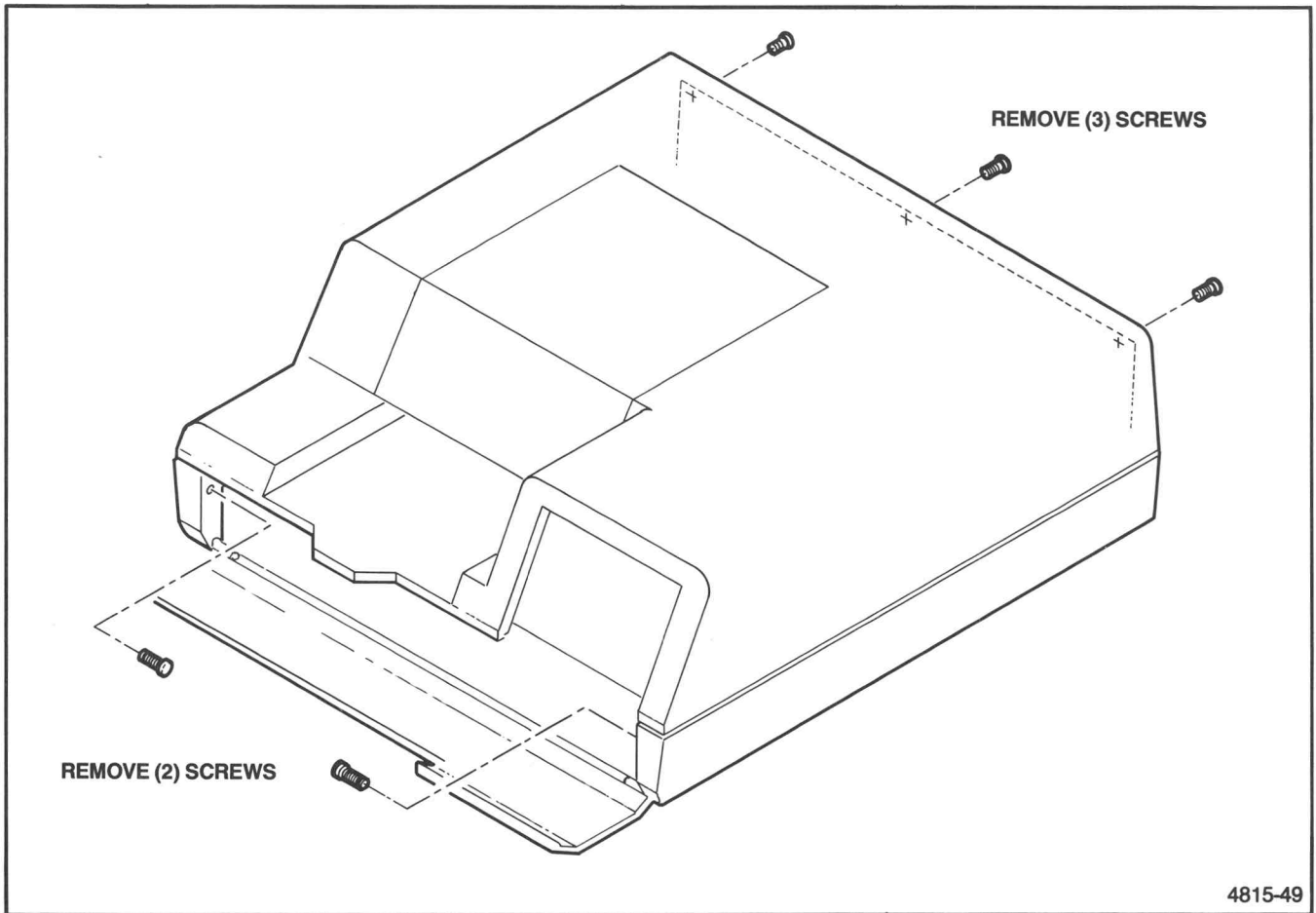


Figure 6-1. Top Cover Attaching Screws.

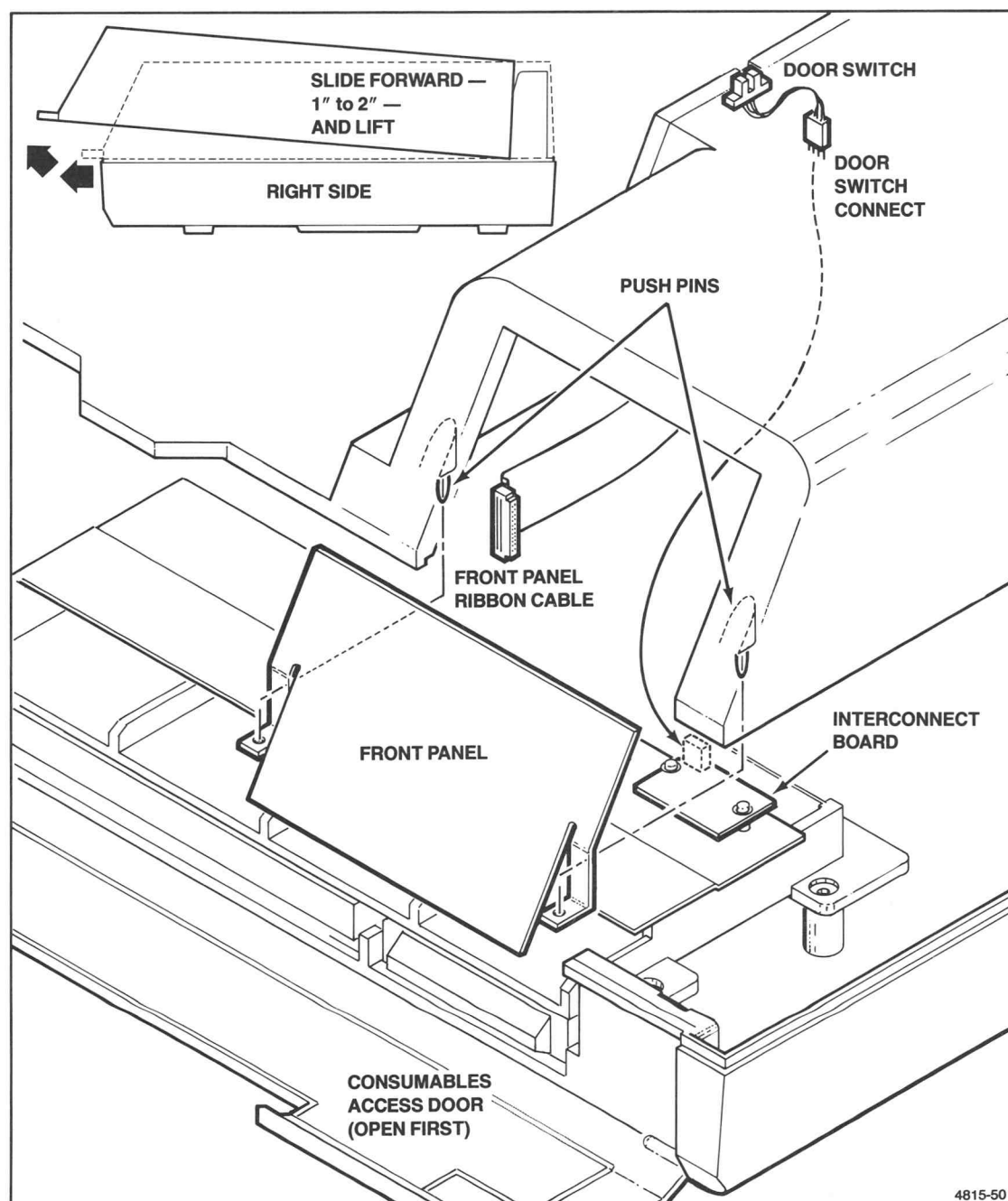


Figure 6-2. Removing the Top Cover.

6.3 ELECTRONIC ASSEMBLY

6.3.1 CIRCUIT BOARD MODULE

The electronic circuit boards are located in the rear of the copier. They are removed and replaced as a package that includes the Parallel Interface, Process Control and Drive Module (with heat sink) boards.

Removal/Replacement

To remove this module:

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord and interface cable(s) from the rear panel.
2. Remove the top cover — see the removal procedure earlier in this section.
3. Remove the cables attached to the Drive Module and Process Control boards. Figures 6-3 show these connectors and their locations.

NOTE

You must detach the cables on the right side of the boards (Figure 6-3b) prior to removing the circuit board assembly. Ensure all cables are removed prior to removing the assembly.

4. Remove the two screws on the rear panel interface connector panel.
5. Remove the two screws attaching the circuit board assembly (specifically, the heat sink) to the bottom cabinet.
6. Lift the assembly up and out of the copier.
7. Reverse these steps to reinstall the circuit board assembly.

Figure 6-4 shows the circuit board assembly and identifies the individual boards and hardware components.

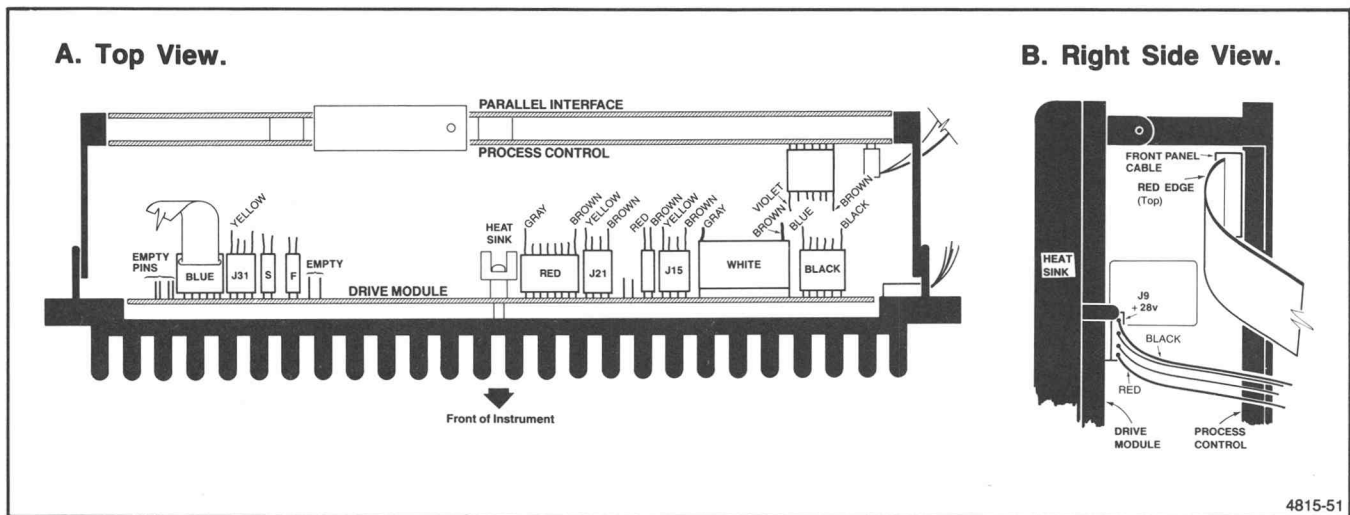


Figure 6-3. Cable Connections to the Circuit Boards.

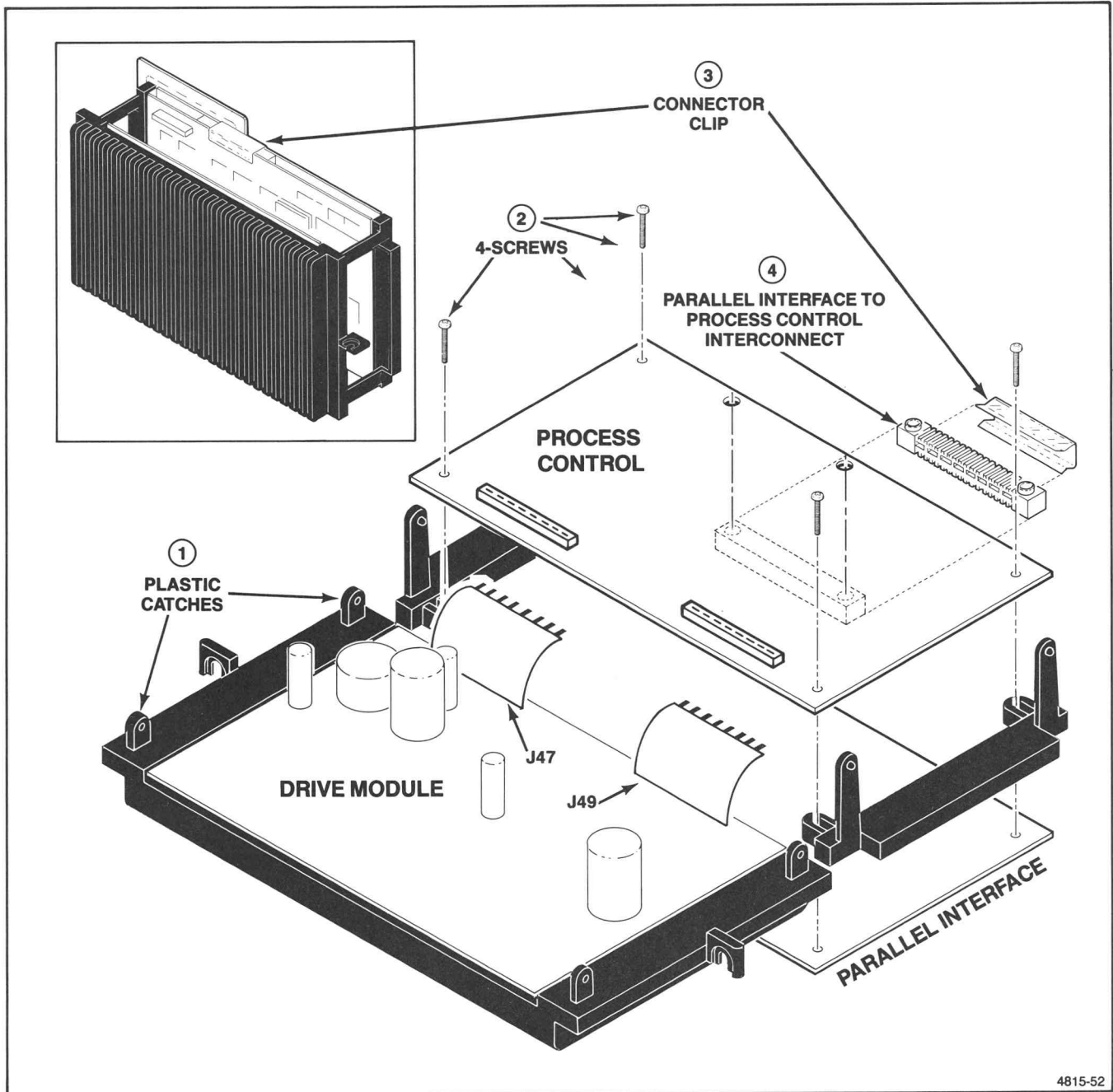


Figure 6-4. Circuit Board Assembly Components.

Disassembly/Assembly

The circuit board module consists of three major sub-assemblies. They are the Drive module with its heat sink, the Process Control, and Parallel Interface boards. The construction of the assembly allows easy disassembly and assembly. Refer to Figure 3-4.

1. Release the four plastic catches (1) which hold the two sub-assemblies together, and lay the boards flat on a table.
2. Carefully unplug the flexible cables connecting the Process Control board to the Drive Module board. These flexible cables shouldn't be removed from the Drive Module board.
3. Remove the four screws (2) holding the Parallel Interface and the Process Control boards together and remove the brackets.
4. Remove the metal clip (3) on the top of the boards. When this clip is removed, the captive connector (4) is free to be removed.
5. The Process Control and Parallel Interface boards can now be repaired or exchanged.
6. Reverse these procedures to reassemble the circuit board module. Take care with:
 - a. Position the captive connector between the Process Control and the Parallel Interface. Note the holes for the connector, on the two boards, are of different sizes. Properly orient the connector to the correct holes during reassembly.
 - b. Attach the flexible cables between the Process Control board and the Drive Module board. Ensure correct pin alignment and that no pins are bent or damaged.

6.4 MECHANICAL ASSEMBLIES

The ink-jet copier consists of five major mechanical assemblies. They are:

- The ink delivery system which includes:
 - Ink-jet head assembly
 - Service loop which houses the plumbing between the ink cartridges and the ink-jet heads
 - Ink cartridges
- The ink-jet head maintenance system which includes:
 - Head maintenance station
 - Maintenance cartridge
 - In-line filter
 - Wash pump
 - Plumbing for the maintenance system
- The regulated air system which includes:
 - Air pump
 - Regulator
 - Accumulator
 - Air Valve (solenoid)
 - In-line filter
 - Plumbing for air supply to ink cartridges and ink-jet heads
- The media handling system which includes:
 - Fluffer assembly (includes the fluffer solenoid)
 - Media input and output trays
 - Media stripper (with stripper solenoid)
 - Blower motor
- The print engine which includes:
 - Drum assembly (including drum motor)
 - Head carriage assembly, and
 - Print engine frame (includes carriage rails)

The following procedures are ordered in a removal sequence. When necessary, you are referred to the procedures that must be performed prior to removing the assembly requiring repair or replacement.

6.4.1 INK-JET HEAD REMOVAL/REPLACEMENT

The ink-jet head assembly consists of the ink-jet head, a sandwich of plastic parts called an Ink Transient Suppressor (ITS), tubes for ink and air, and a 3-way valve. Replacement assemblies are filled with distilled, deionized water and are replaced as a unit to minimize opportunities for contamination.

CAUTION

Take special care not to shock or jar the ink-jet head assemblies or pinch the tubing. Mishandling the ink-jet assemblies may induce air bubbles into the ink-jet heads causing them to fail. Do not directly wipe the ink-jet orifice or place pressure against the face of the ink-jet. It is quite fragile and the orifice can be clogged by contaminants from your fingers or a tissue.

Recommended Tools and Supplies

- Air Pressure Gauge (with T-tubing connector)
- 6 oz. wash bottle filled with distilled water
- Tweezers with tapered, angled tips
- 7/64 hex (Allen) wrench or driver
- 5 x 8 inch plastic card or other moisture barrier
- absorbent toweling, such as KIMWIPES®
- tubing clamps (2)
- Pozidrive® screwdriver with #2 tip
- 067-1204-00 4692 Threshold Voltage Pattern Generator Test Fixture (if available)

When replacing an ink-jet head, you will do the following:

- Enter the copier's Service mode to start the Air Routine. This pressurizes the ink system. Section 2.3.3 explains Service mode.
- Press the PURGE switch which shuts off the air flow to the ink-jet heads, causing them to "flood" with ink. Pressing the PURGE switch also increases the air pressure applied to the ink bladders, speeding the flooding process.
- Once flooded, you remove the ink-jet head, 3-way valve, and ITS and replace it with the new ink-jet head assembly. When replacing the ink-jet head you use a technique of developing a meniscus on the ends of the ink supply line and the 3-way valve nipple to which the line connects. This ensures a "wet connection" between the ink-line and the new ink-jet assembly, minimizing the chance of air bubble contamination.

NOTE

The term "wet connection" identifies the process required to ensure that air does not enter the ink supply system. If the meniscus is present on both the 3-way valve and the ink line at the time of connection, no air will enter the ink supply line.

A wet connection is the best known method to ensure the integrity of the ink supply system.

- Once installed, you allow the ink-jet heads to continue purging to flush the distilled water out of the new ink-jet head. Following this, you run test patterns to verify the ink-jet head operation, and to check and adjust the head alignment (convergence).

Setup

1. Press the POWER OFF switch. When the copier completes the power-down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover (see Section 6.2.1 "Top Cover").
3. Install the air pressure gauge (see Figure 6-6a) to monitor the system pressure during the procedure. Monitoring the air pressure alerts you to system malfunctions (such as air leaks) during the ink-jet head replacement procedure.

If available, also connect the 4692 Threshold Voltage Pattern Generator to the copier as a source of additional test patterns and ink-jet head tests.

4. Reconnect the power cord and press POWER ON.

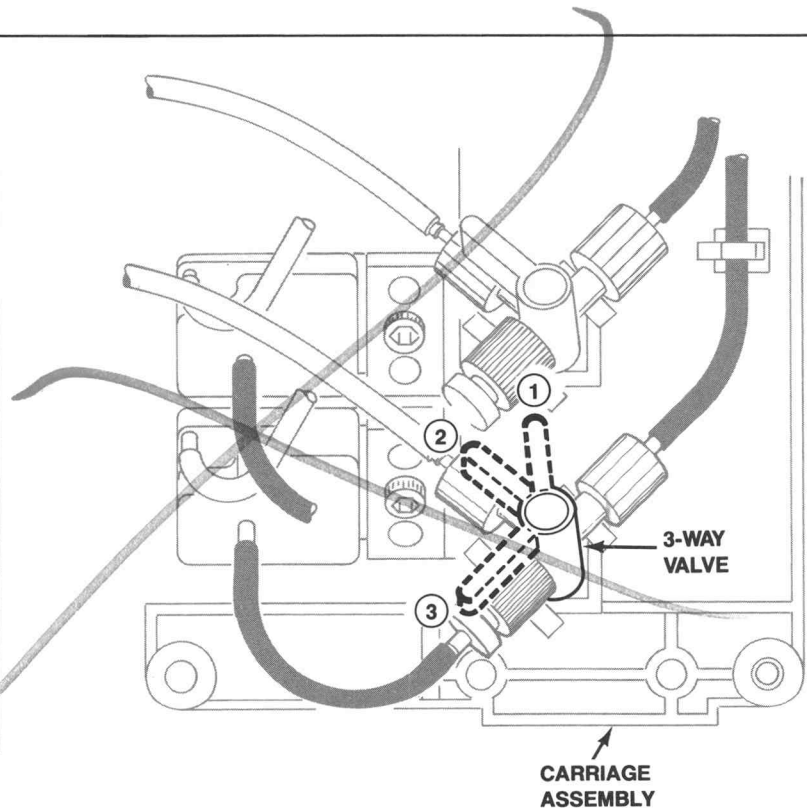
NOTE

The power will be left on during this entire procedure to provide positive pressure throughout the ink supply system. This procedure greatly reduces the possibility of air entering the ink supply system or the ink-jet heads.

5. Press and hold the STOP COPY switch and then press the TEST switch to enter the Service mode. The READY and FAULT lights begin flashing when the copier enters the Service mode.

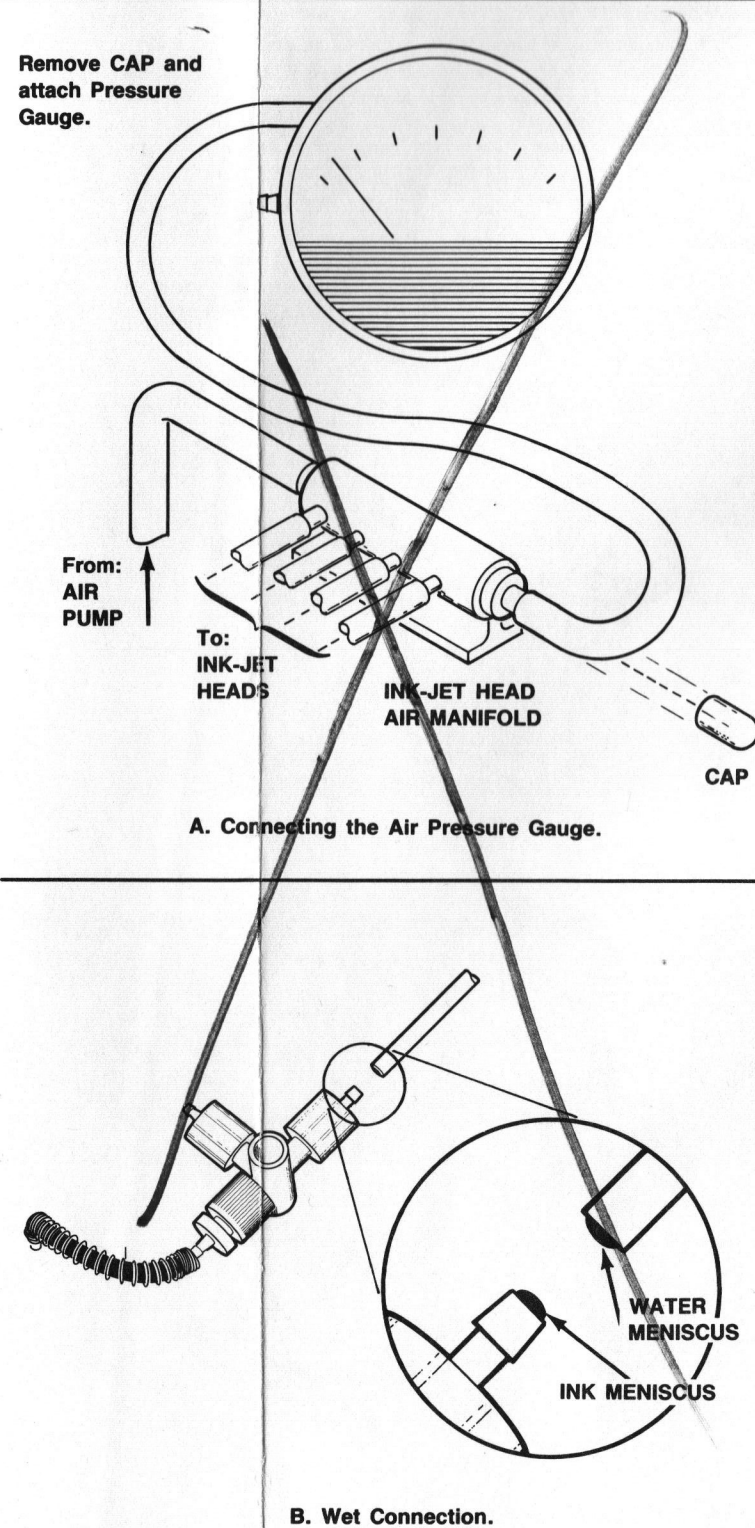
6. To enter the Air Routine (Service Test 1), press the TEST switch and release it, when the PORT 1 indicator illuminates. Press STOP COPY, if you accidentally start the wrong test, and try again. With the air system on you should read about 31 inches of water on the air pressure gauge.
 7. Press the PURGE switch. This shuts off the air to the ink-jet heads and increases the air pressure on the ink bladders allowing the chambers in the ink-jet heads to flood with ink. The pressure gauge should read greater than full scale (the actual pressure will be about 80 inches of water). Wait twenty seconds to allow complete ink-jet head flooding.
- ### Removal
- Figure 6-6 illustrates the removal and replacement procedures.
1. Remove the head carriage cover, and turn the four 3-way valves off (position 1 in Figure 6-5).
 2. Lay the moisture barrier and absorbent toweling on the carriage rails to the right of the head carriage.
 3. Unplug the selected ink-jet head's red/white signal cable.
 4. Gently pry the 3-way valve of the ink-jet head to be replaced upward to release it from its snap-in fitting.
 5. Clamp the ink supply line about one inch "upstream from" the 3-way valve and then *slowly and gently* remove the ink supply line from the 3-way valve.
 6. Remove the selected ink-jet head's air line from the head carriage air manifold and connect the air line to the ink supply nipple of 3-way valve from which you just removed the ink supply line.
 7. Loosen the single 7/64" Allen screw attaching the ink-jet head to the head carriage. Do not remove the screw completely.
 8. To remove the ink-jet head from the carriage, gently twist and tilt the ink-jet assembly while pulling it off the head carriage. When removed, carefully store the ink-jet assembly in a plastic bag to return to the factory for rework.

POSITION	FLUID FLOW
1	CLOSED
2	OPEN
3	PURGE

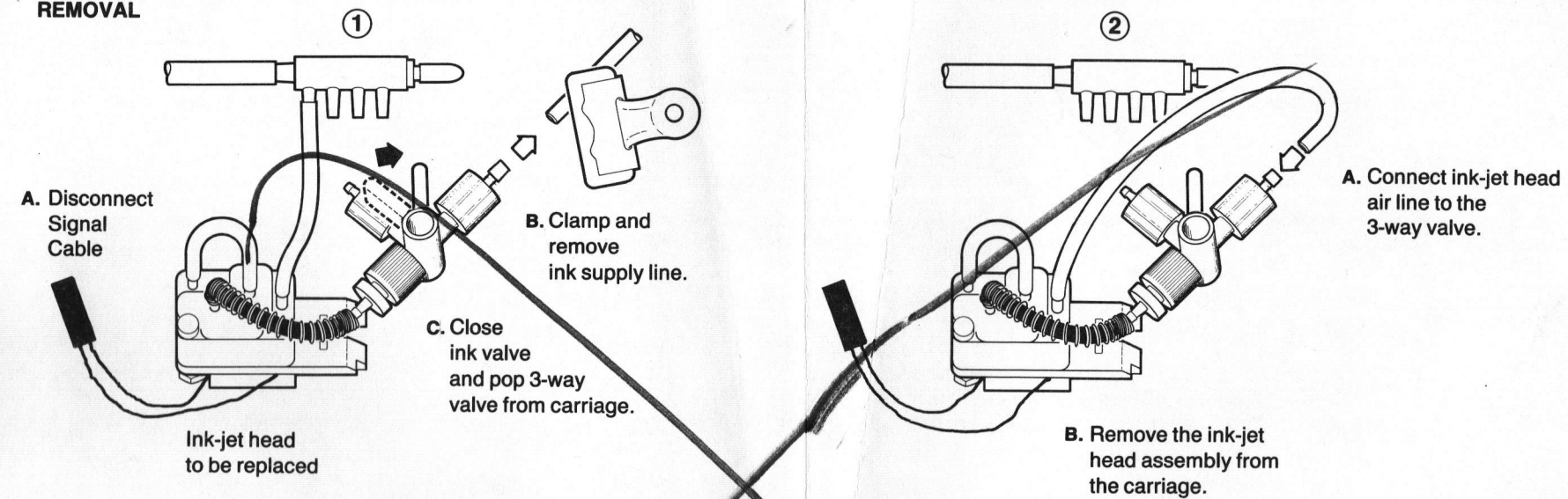


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Figure 6-5. 3-way Valve Detail.



REMOVAL



REPLACEMENT

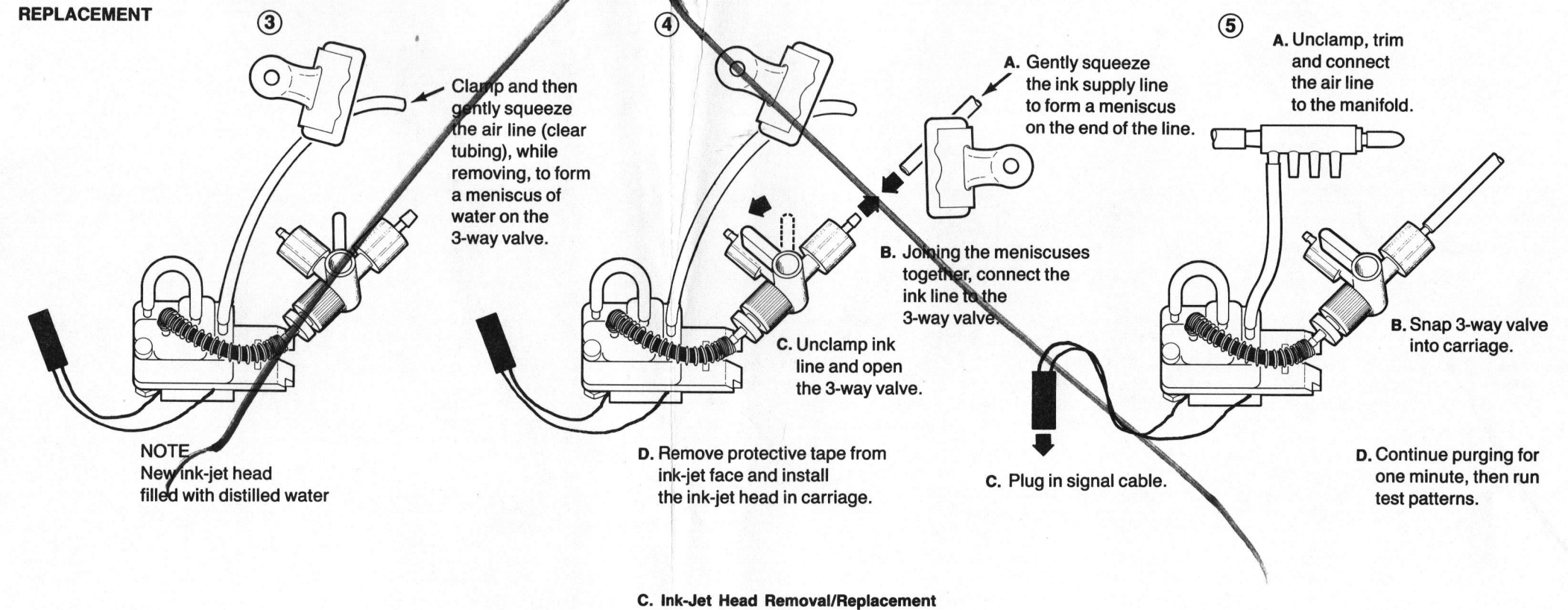


Figure 6-6. Ink-jet Head Replacement Procedure.

Replacement

CAUTION

HANDLE WITH CARE. Air bubbles may be induced into the new ink-jet head if it is bumped or dropped.

1. Lay the new ink-jet head assembly next to the carriage.

Ensure the assembly's 3-way valve is closed (position 1).
2. Clamp and then gently remove the clear air line from the ink supply nipple of the 3-way valve. When you do this, gently squeeze the air line to force a small drop of water onto the nipple of the 3-way valve to form a meniscus.
3. Grasp the clamped ink supply line and gently squeeze it to form a meniscus of ink on the end of the ink line. As an alternative to squeezing the ink-line, you can loosen and then retighten the clamp on the ink line, allowing some ink to flow and form a meniscus.
4. Carefully connect the ink supply line with the 3-way valve by joining the two menisci together to form an air-free connection as you slide the ink line onto the nipple.
5. Remove the ink supply line clamp and slowly turn the 3-way valve to the open position (position 3).
6. Gently remove the adhesive strip covering the face of the ink-jet head. You should observe fluid drooling from the ink-jet orifice in the center of the face. Taking care to protect the face of the ink-jet head, install the ink-jet head into the head carriage. Snap it into place and tighten the Allen screw.
7. Connect the air line to the air manifold and remove the clamp on the air line. When unclamped, the fluid in the hose will drain. If necessary, clip off any excess tubing before connecting the line to the air manifold. Don't leave the air line disconnected for more than a few seconds to minimize the chance for contamination.

NOTE

New ink-jet head assemblies are filled with degassed, deionized water to enhance the replacement procedure. This fluid must be flushed out with ink after you install the new assembly by allowing the purge cycle to continue.

8. Gently install the 3-way valve into its snap-in fitting.
9. Observing the correct polarity, plug in the ink-jet head's red/white signal cable (red wire = right side).
10. Allow purging to continue for about one more minute to complete flushing and then open the 3-way valves (position 3 in Figure 6-5) of the other three ink-jet heads.

NOTE

It is important to turn the 3-way valves to the open positions (normal operating positions) before stopping the purge cycle or stopping the Air Routine. Otherwise, air may be inducted into the ink-jet heads, rendering them inoperative.

11. Press PURGE to stop the purge cycle and wait at least 15 seconds.
12. Press STOP COPY to stop the Air Routine and then press CLEAR to exit the Service mode.
13. Make some Solid Fill (TEST #2) test patterns to check out the new ink-jet head. The first few copies may be "washed out" due to water remaining in the ink system. Once the ink-jet head performs properly, perform the convergence adjustment procedure on the new ink-jet head (see Section 5.4.1 "Checking Ink-Jet Head Performance") to check and adjust the ink-jet head alignment.
14. If the Threshold Voltage Test Generator is connected, exercise the new ink-jet head to produce an ink-jet head performance profile. After the new ink-jet head performance is assured, it is a good idea to profile the other ink-jet heads to verify proper performance.
15. Replace the head carriage cover when the convergence adjustment is complete.

6.4.2 HEAD CARRIAGE ASSEMBLY

Most maintenance procedures do not require removal of the ink-jet head carriage assembly. Use this procedure if the carriage itself is damaged or if the carriage rail assembly must be removed to access the drum assembly.

CAUTION

Whenever you remove the head carriage, do not place the assembly near or over the circuit board assembly. If ink enters the circuit assembly, the conductive ink may cause electrical shorting.

Avoid pinching or crimping the ink lines.

Avoid bumping or dropping the head carriage assembly as mechanical shock may induce air bubbles in the ink lines or heads.

Removal/Replacement

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover — see Section 6.2.1 "Top Cover."
3. Remove the head carriage cover.
4. Turn off (1) the ink-jet 3-way valves. Refer to Figure 6-7a for the proper positioning of the valve handles.
5. Remove the two screws (2) attaching the head carriage to the head carriage bearing.

6. Lift the front edge of the carriage up about one to two inches (3), and carefully slide the entire assembly toward the front of the copier until it detaches from the mount on the rear carriage rail bearing.

CAUTION

The ink-jet heads should not be left off the head capping station for more than a few hours.

7. Place some absorbent material on top of the blower and rest the head carriage assembly (upside-down) on the blower.
8. Reverse these steps to replace the head carriage assembly.

NOTE

When installing the head carriage, push the carriage firmly onto the rear bearing. This ensures proper placement of the ink-jet heads for convergence.

See change info.

6.4.3 HEAD MAINTENANCE SYSTEM

The head maintenance system includes the maintenance fluid cartridge, wash pump, and the head maintenance station. The disposable cartridge provides maintenance fluid for flushing the ink-jet heads and a reservoir for the waste maintenance fluid. Figure 6-8 illustrates these components.

If the seals of the head maintenance station leak, clean the station and adjust its tension — see Section 5.2.5 “Head Maintenance Station Tension.” If the seals are abraded or torn, the head maintenance station must be replaced as a unit. Periodically inspect the head maintenance station for leaks or contamination. Carefully, clean with distilled water and a lint-free tissue as described in Section 4.3.4 “Cleaning the Head Maintenance Station.”

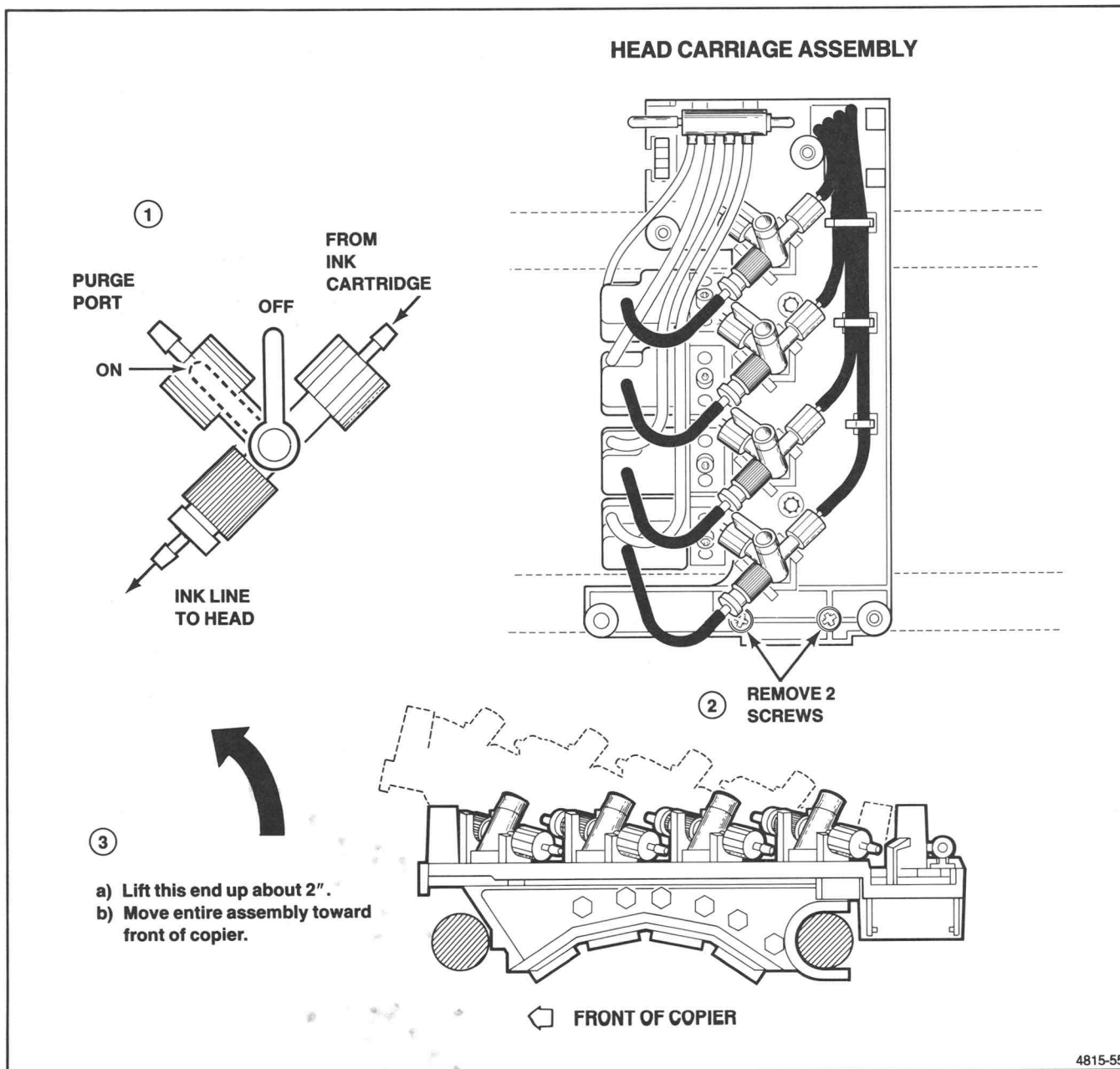


Figure 6-7. Removing the Head Carriage Assembly.

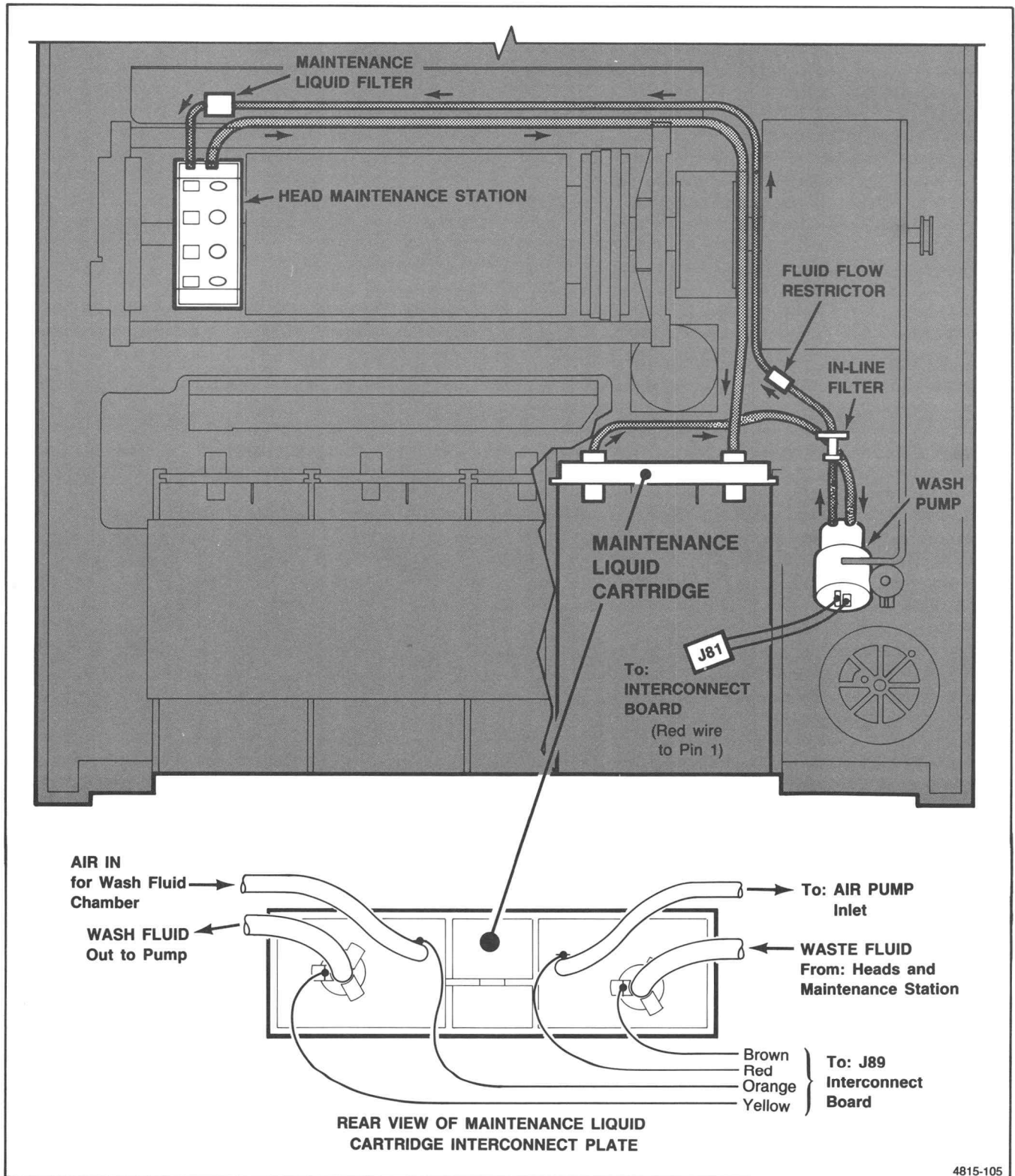


Figure 6-8. Head Maintenance System Components.

Removal/Replacement

Cleanliness is important whenever any of the head maintenance components are removed or replaced.

CAUTION

Any foreign material entering the maintenance system will be carried to the ink-jet heads during a wash cycle.

Head Maintenance Station. The following steps tell how to access and remove the head maintenance station. Refer to Figure 6-9.

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover — see Section 6.2.1 “Top Cover.”
3. By pulling the head carriage drive belt, manually move the head carriage to the middle of the carriage rails.

NOTE

The ink-jet heads may drip a little ink on the drum. Wipe up with a clean lint-free towel.

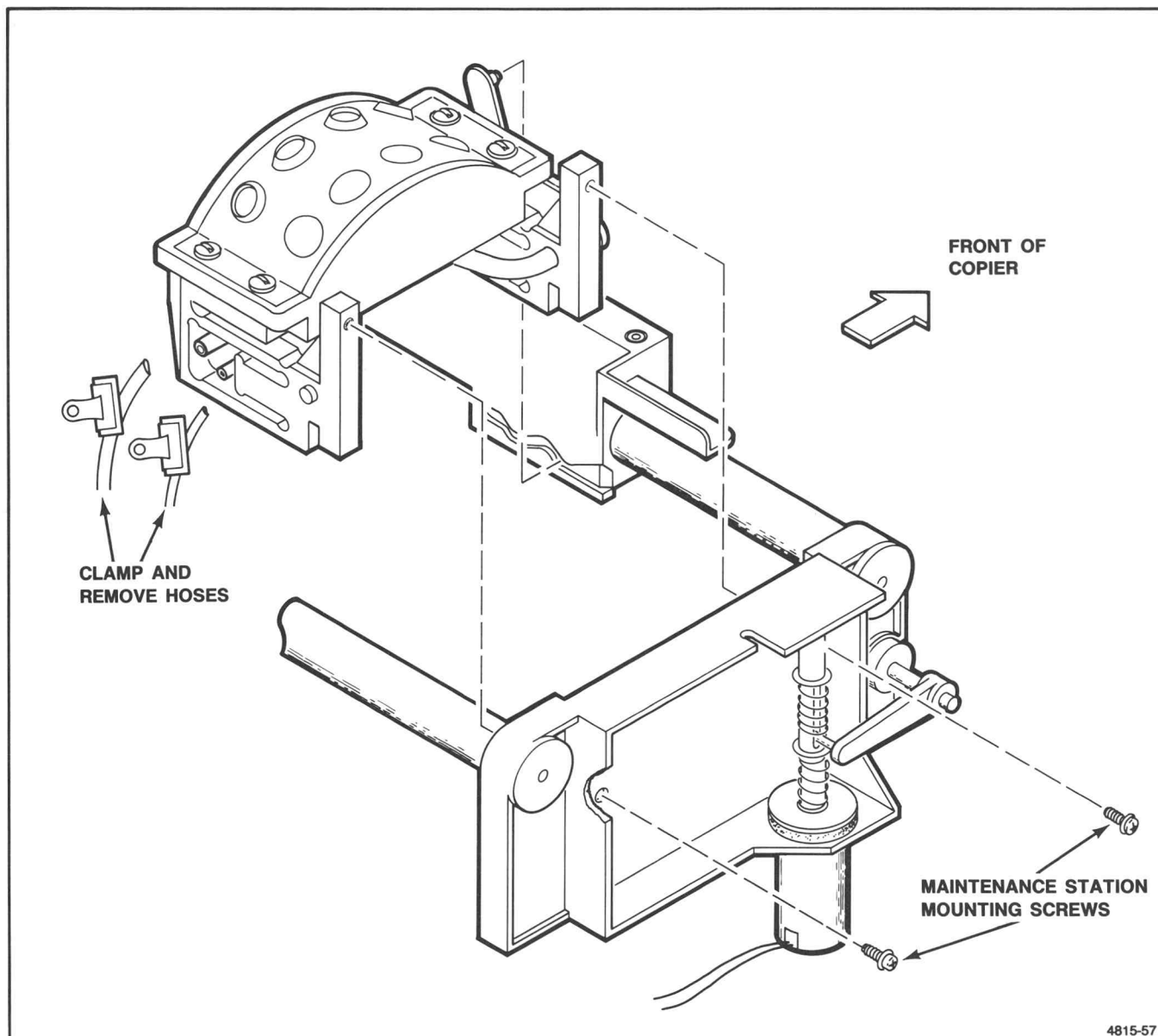
CAUTION

The ink-jet heads should not be left uncapped for more than a few hours.

WARNING

The ink is electrically conductive. If it spills on or near the electronic areas of the copier, a diligent cleanup is mandatory!

4. Place an absorbent towel behind the head maintenance station. Disconnect the two wash hoses at the rear of the head maintenance station (see Figure 6-9) and clamp them to avoid leakage. The towel should catch any leakage.
5. Remove the two mounting screws (see Figure 6-9) and lift the maintenance station straight up and away from the copier.



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Figure 6-9. Head Maintenance Station Removal.

MECHANICAL DISASSEMBLY/ASSEMBLY

6. To replace the maintenance station, reverse these procedures. A new or replacement unit requires you to align the arm that mates with a cam slot in the head carriage bearing (Figure 6-10). You need a 7/64" Allen driver to make this adjustment.
7. After mounting the head maintenance station and reattaching the wash hoses, return the head carriage to the head wash position. Check to make sure the arm on the maintenance station mates with the slot on the side of the head carriage bearing. Loosen the Allen screw if necessary.
8. Adjust the head maintenance station tension seal pressure (on the ink-jet heads) by following the procedure in Section 5.2.5 "Head Maintenance Station Tension."

Wash Pump. To remove the wash pump:

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover. See Section 6.2.1 "Top Cover."
3. Disconnect J81 from the Interconnect board.
4. Remove the two screws securing the wash pump bracket to the cabinet bottom.
5. Lift the wash pump up, clamp the two wash hoses, and then remove them from the wash pump.
6. Remove the two screws from the wash pump bracket, and attach the bracket to the replacement wash pump.

7. Remove the electrical cable from the old wash pump and attach it to the replacement wash pump. The red wire connects to the "+" connection on the wash pump.
8. Attach the two wash hoses to the new wash pump and remove the clamps.

NOTE

The wash pump body features two arrows which indicate which port is IN and which is OUT. Be sure the hose from the maintenance cartridge connects to the IN port and the hose to the head maintenance station connects to the OUT port.

9. Using the two screws, secure the new wash pump to the bottom frame. DO NOT over-tighten these screws.
10. Connect J81 to the Interconnect board. The red wire connects to pin 1 (square pad) on the board.

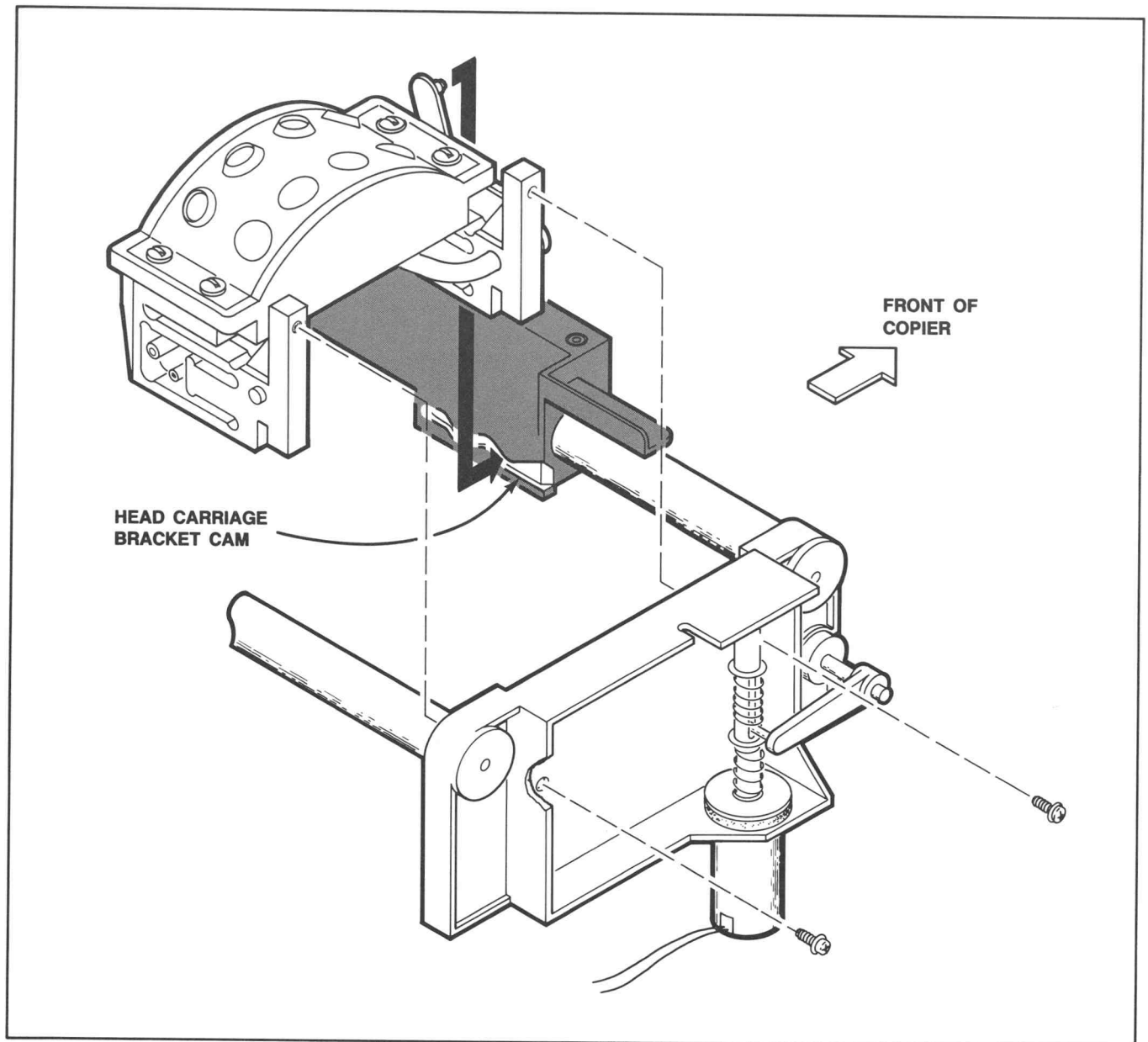


Figure 6-10. Alignment of Head Carriage Cam and Maintenance Station Arm.

6.4.4 CARRIAGE MOTOR AND BELT

The carriage motor and belt do not require any periodic maintenance or replacement. Use this procedure only if you suspect the belt or motor is defective.

Removal/Replacement

1. Press the POWER OFF switch. When the copier completes the power-down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover — see Section 6.2.1 “Top Cover.”
3. Loosen the screw retaining the left belt pulley bracket. The drive belt will slacken.
4. Remove the screw and clamp, at the front of head carriage, attaching the head carriage to the drive belt. Remove the drive belt.
5. Remove the screws retaining the carriage motor. Disconnect the motor cable (black 6-wire connector on right side of Drive Module board), work the cable free and remove the motor.
6. Install the carriage motor and the belt by reversing the above procedure. Perform the belt tension adjustment procedure in Section 5.2.3 “Drive Belt Tension.”

6.4.5 CARRIAGE RAILS ASSEMBLY

The carriage rail assembly consists of the left and right frame castings, carriage rails, stripper solenoid, and the stripper shaft. The frame ends and carriage rails are bonded together at the factory, and are replaced as a unit only. This assembly does not include the stripper arm or the stripper solenoid which may be ordered and replaced separately.

Removal/Replacement

1. Press the POWER OFF switch. When the copier completes the power-down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover — see Section 6.2.1 “Top Cover.”
3. Remove the head carriage assembly — see Section 6.4.2 “Head Carriage Assembly.”
4. Remove the head maintenance station — see Section 6.4.3 “Head Maintenance System.”
5. Disconnect the stripper solenoid cable from J20 on the Drive Module, and remove it from the cable bundle on the left side of the cabinet bottom.

NOTE

Transfer the Stripper Solenoid and Stripper to the new carriage rail assembly. Refer to the procedures following this procedure.

6. Remove the HOME opto-switch bracket from the left frame casting and set it aside.
7. Refer to Figure 6-11. Loosen the clamp (1), located on the front of the head carriage, attaching the head carriage to the drive belt.
8. Locate the three screws (2) near the left end of the drum. One screw secures the drum shaft and the other two secure the carriage rail assembly to the chassis bottom. Remove all three screws.
9. Remove the one screw (3) located at the right end of the drum shaft. Lift and remove the carriage rail assembly from of the copier.
10. Reverse these steps to replace the carriage rail assembly.

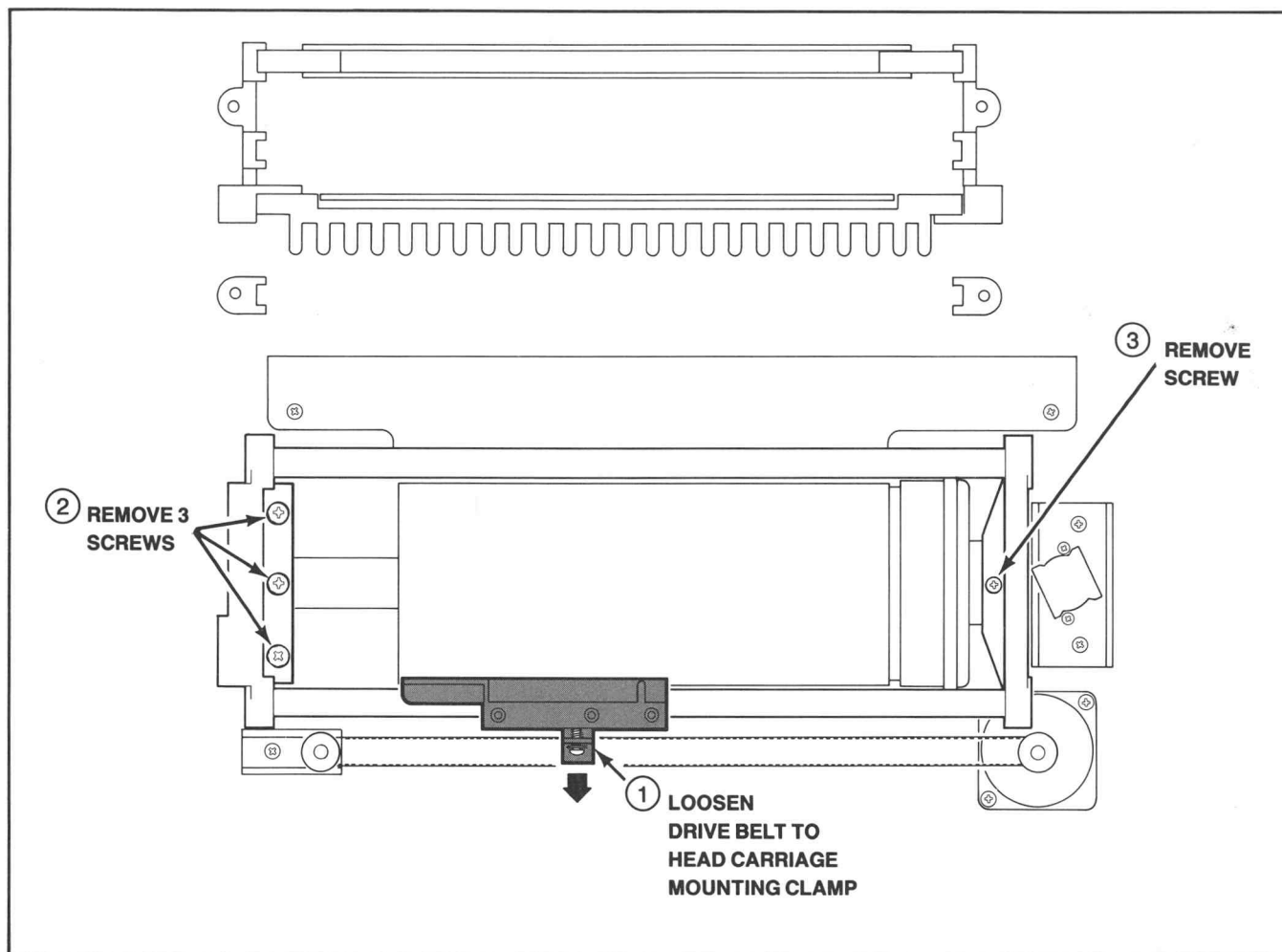


Figure 6-11. Carriage Rail Assembly.

Stripper. The stripper mounts to the carriage rail assembly. To remove the stripper:

1. Press the POWER OFF switch. When the copier completes the power-down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover. See Section 6.2.1 "Top Cover."
3. Remove the screw holding the left belt pulley bracket, and set the bracket aside.

Figure 6-12 shows an exploded view of the stripper removed from the carriage rail assembly.

4. Remove the retaining ring (E-ring) from the left end of the stripper.
5. Slide the stripper to the left to clear the mounting position, and then forward (toward the front of the copier).
6. Reverse this procedure to install the new stripper. When installing the new stripper, lift the top spring on the stripper solenoid, and insert the stripper arm. See the insert drawing in Figure 6-13b.
7. When you install the left belt pulley bracket, use the procedure in Section 5.2.5 "Head Maintenance Station Tension" for setting the proper tension on the carriage drive belt.

Stripper Solenoid. Although the stripper solenoid is mounted to the carriage rail assembly, it is not part of the carriage rail replacement assembly. To remove the stripper solenoid:

1. Press the POWER OFF switch. When the copier completes the power-down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover — see Section 6.2.1 "Top Cover."
3. Remove the carriage drive belt left pulley bracket. Disconnect the drive belt from the head carriage.
4. Remove the retaining ring (E-ring) from the left end of the stripper. Remove the stripper.

NOTE

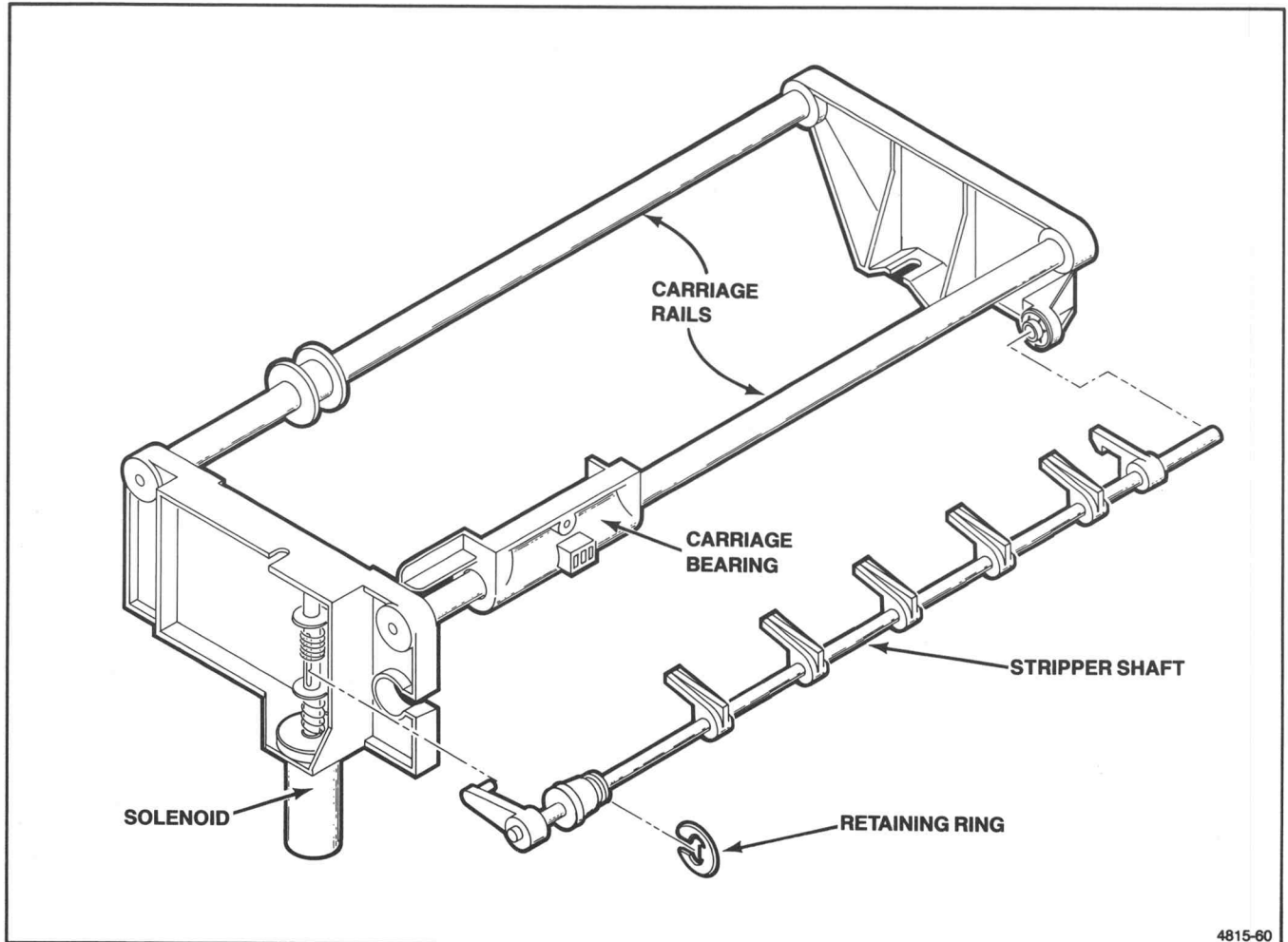
The solenoid nuts are secured with Loctite®. You'll need two pairs of pliers to remove them. A new nut is provided with the replacement solenoid, since the original nut will have Loctite in the threads.

5. Using two pairs of pliers, unscrew the solenoid nut from the top of the solenoid assembly. Be sure the cushion pad is installed in its proper place during reassembly.
6. Disconnect the solenoid (J29) from the Process control board. Unclip and remove the signal cable from the tie-down clip on the left side of the cabinet bottom.
7. Replace the stripper solenoid by following these steps in reverse order.

NOTE

When placing the stripper arm in the solenoid rod slot, make sure that the two springs are properly located. See the Figure 6-13b insert for the proper placement of the springs.

8. Secure the solenoid nut with a threadlock adhesive such as Loctite® 290 (Tektronix P.N. 006-2579-00). This is a wicking adhesive applied after the nut is fully installed and contacting the metal body of the solenoid. Ensure the solenoid is free to move slightly in the rail frame.



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Figure 6-12. Stripper.

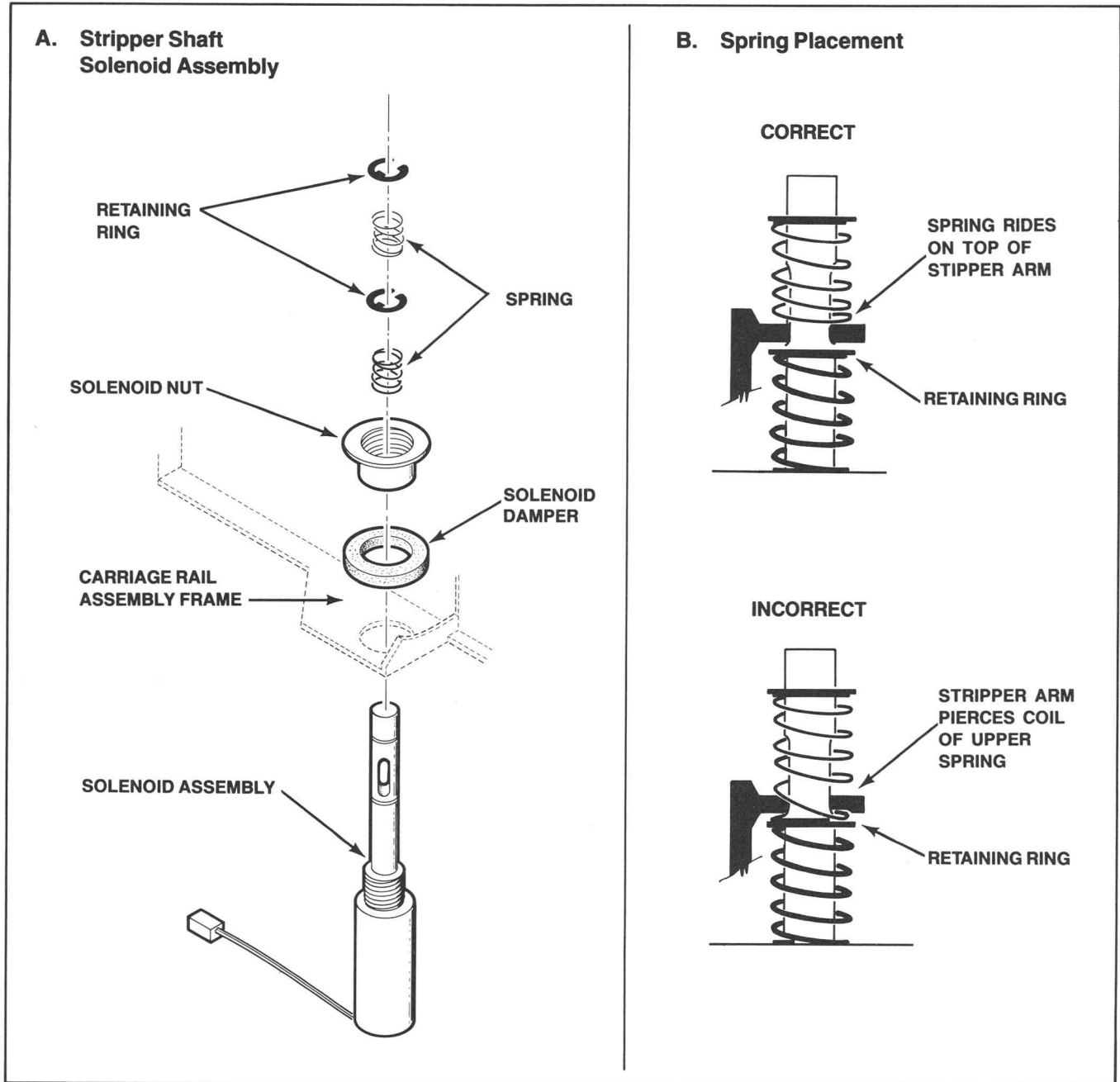


Figure 6-13. Stripper Solenoid.

6.4.6 DRUM ASSEMBLY

The drum assembly consists of the drum with captive bearings, drum motor/shaft, flywheel, magnet cup, and hardware. Potential causes for replacement are bearing or motor failure. The bearings are a high grade, "sealed" type, and the drum should turn easily and smoothly, with no perceptible side play. However, since the blower continually sucks ink overspray and paper dust through the interior of the drum, even "sealed" bearings may become contaminated and fail. This necessitates the need for drum replacement.

Removal/Replacement

1. Remove the top cover — Section 6.2.1 "Top Cover."
2. Remove the head carriage assembly — Section 6.4.2 "Head Carriage Assembly."
3. Remove the head maintenance station — Section 6.4.3 "Head Maintenance System."
4. Remove the carriage rail assembly — Section 6.4.5 "Carriage Rail Assembly."
5. Detach J23 (red connector) from the Drive Module board and remove it from the cable tie-down at the right end of the circuit boards.
6. Remove the two screws securing the vacuum switch/drum bracket on the right end of the drum — see Figure 6-14a. Set the switch/drum bracket assembly aside. Taking care not to stress the motor cable, lift the drum assembly out of the copier.

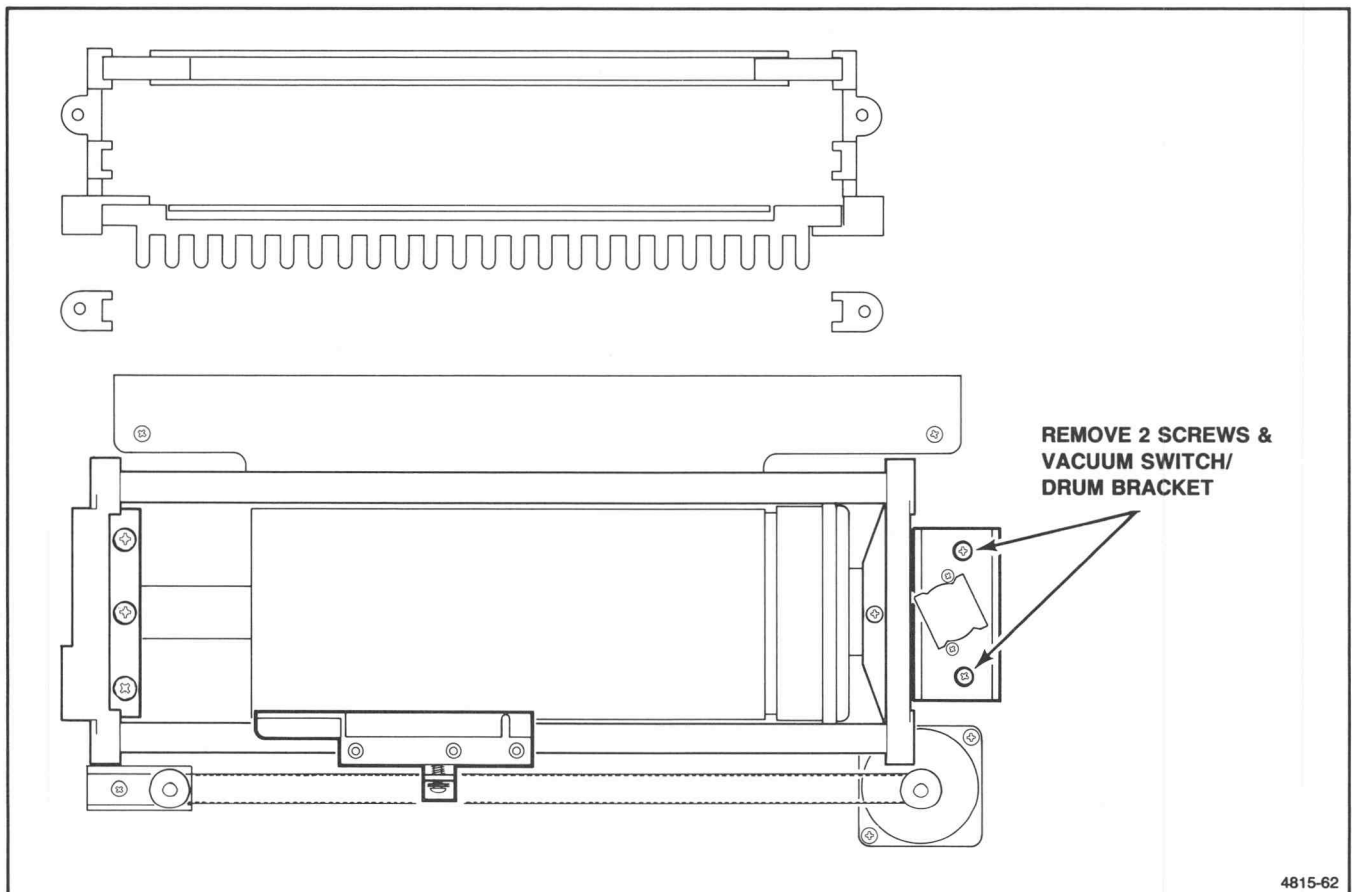


Figure 6-14a. Drum Assembly Removal.

Installation

1. Install the replacement drum assembly (see Figure 6-14b) into the copier with the left end of the drum against the end of the drum shaft slot.
2. Attach the carriage rail assembly to the drum with one screw on each end.
3. Lift the right end of the drum up about 1 inch and slide the drum to the right until the carriage rail frame touches the locating boss (pin).

CAUTION

If the drum is not lifted before sliding, the o-ring on the right end of the drum may be pulled out of place. This will create a vacuum leak.

4. Carefully place the right end of the drum back into its slot.
 5. Install the two screws attaching the left end of the carriage rail assembly to the bottom cabinet.
 6. Install the vacuum switch/drum bracket on the right end of the drum.
- NOTE**
- The vacuum switch/drum bracket securing the right end of the drum has an alignment pin on the bottom. If you encounter trouble when attaching this bracket, this note may be the hint you need.*
7. Route the drum motor cable to the Drive Module board and connect to J23 with the brown wire on your right (as observed from the front of the copier). Be sure to route the wiring harness under the service loop bracket (or else it will interfere with the service loop action during imaging).
 8. Reinstall the head maintenance station, carriage rail assembly, and head carriage assembly.
 9. Perform the ink-jet head performance checks as described in Section 2.5.1. Adjusting the ink-jet head convergence or head maintenance station tension may be necessary.
 10. Reinstall the top cover.

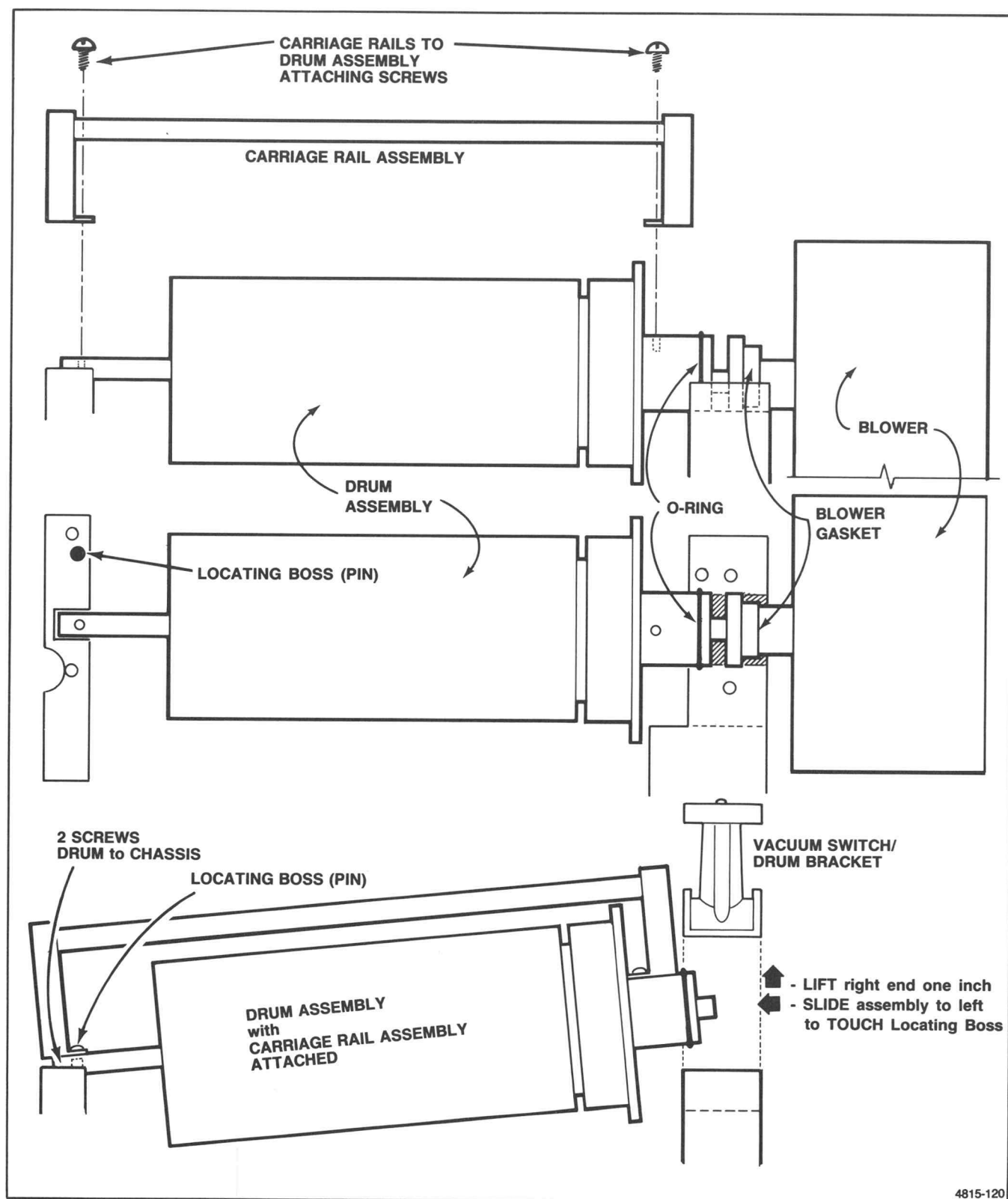


Figure 6-14b. Drum Assembly Replacement.

6.4.7 BLOWER MOTOR

The vacuum blower draws air through the holes in the drum and exhausts it through the air duct molded into the bottom cabinet. The air holes provide a vacuum which holds the media to the drum during imaging. The air duct channels the blower exhaust into the paper fluffer assembly. When the fluffer solenoid is activated during media loading, the air is directed toward the media input tray. This air flow lifts the top sheet of media toward the drum to facilitate media loading. After the media is loaded, the fluffer solenoid deactivates. Another vent in the fluffer assembly directs the exhaust air toward the electronic and electro-mechanical areas of the copier for cooling.

Figure 6-15 shows the air flow through the air/vacuum system.

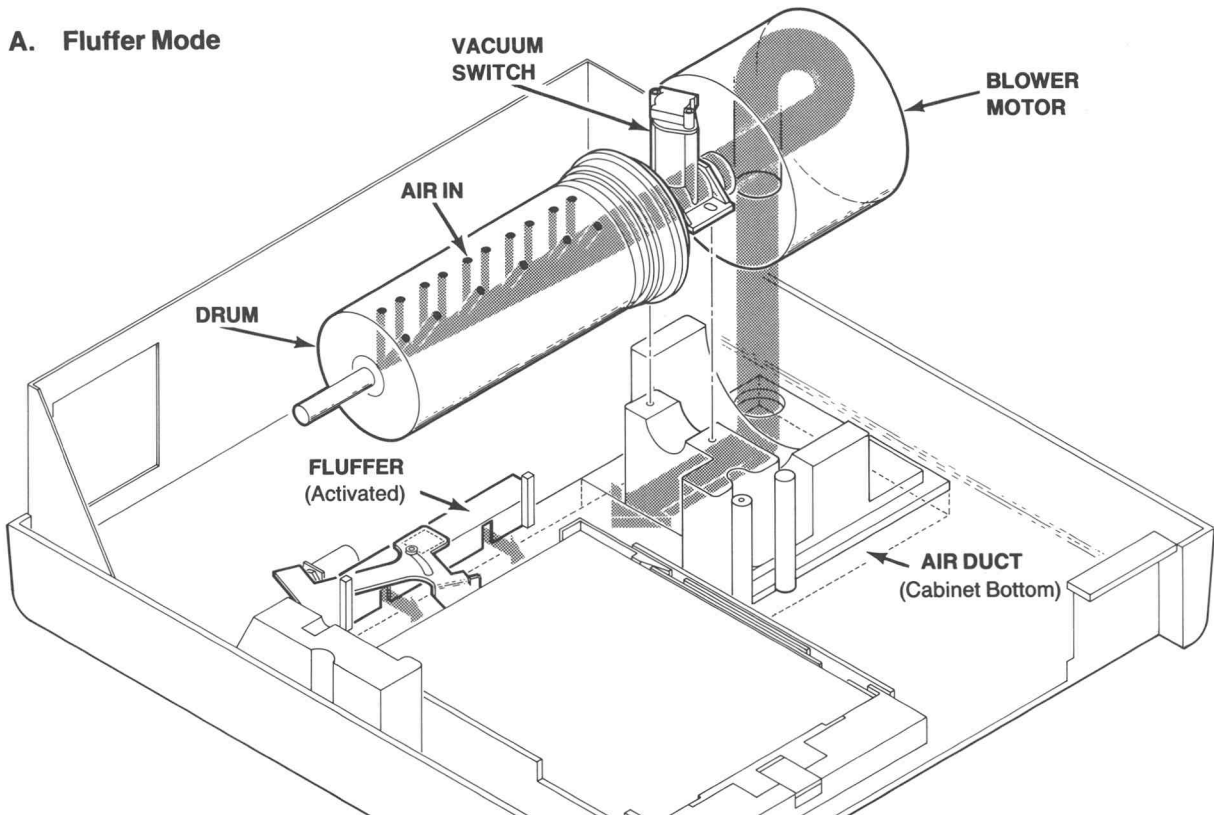
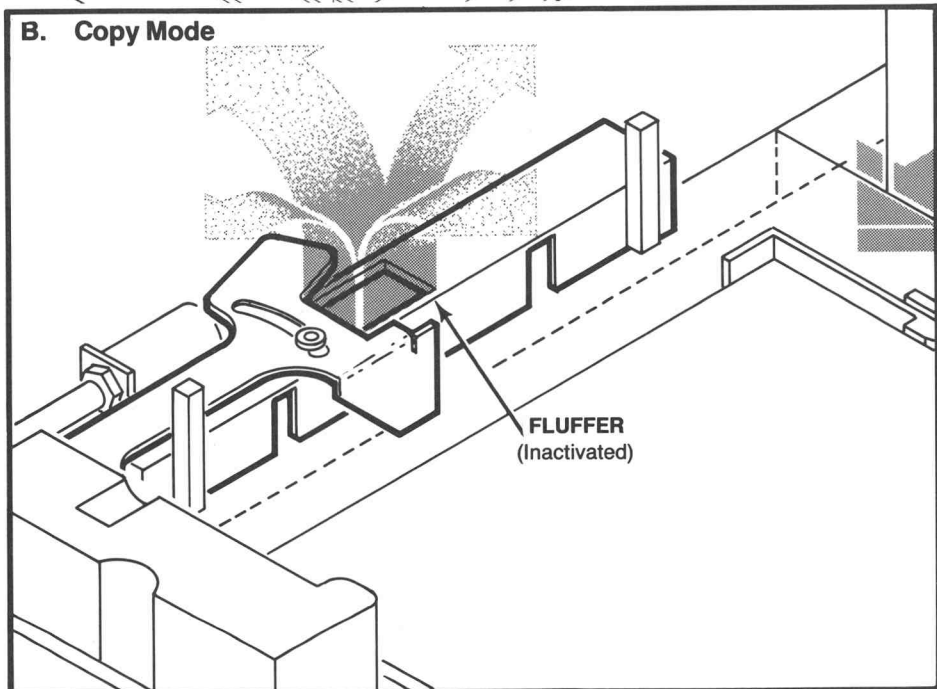
A. Fluffer Mode**B. Copy Mode**

Figure 6-15. Air Flow for Drum and Fluffer.

Removal/Replacement

Refer to Figure 6-16 for removal/replacement information.

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover. See Section 6.2.1 "Top Cover."
3. Disconnect J13 from the Drive Module board.
4. Remove the vacuum switch/drum bracket. Refer to Figure 6-16.
5. Release the rubber retaining strap securing the blower to the cabinet bottom.
6. Remove the drive belt connecting the blower motor pulley to the air pump pulley.
7. Remove the screw holding the blower/air pump bracket to the cabinet bottom.
8. Raising the bracket slightly, use a 7/16" wrench to remove the three bolts securing the blower to the bracket. Remove the blower.
9. Inspect the blower gasket at the blower inlet. Replace the gasket if it appears worn or deformed. If you must replace the gasket, ensure that you install the gasket as far onto the inlet as it will go. If incorrectly installed, it may slip to the left and cover the hole to the vacuum switch/drum bracket, rendering the switch inoperative.
10. Using a 5/64" Allen driver remove the pulley from the end of the blower shaft. Attach the pulley to the shaft of the new blower.
11. Install the new blower and reverse these steps to install the new part. Ensure that the pulley wheel lines up with the air pump pulley wheel.

NOTE

When installing the blower motor, the output vent points down into the hole in the bottom cabinet.

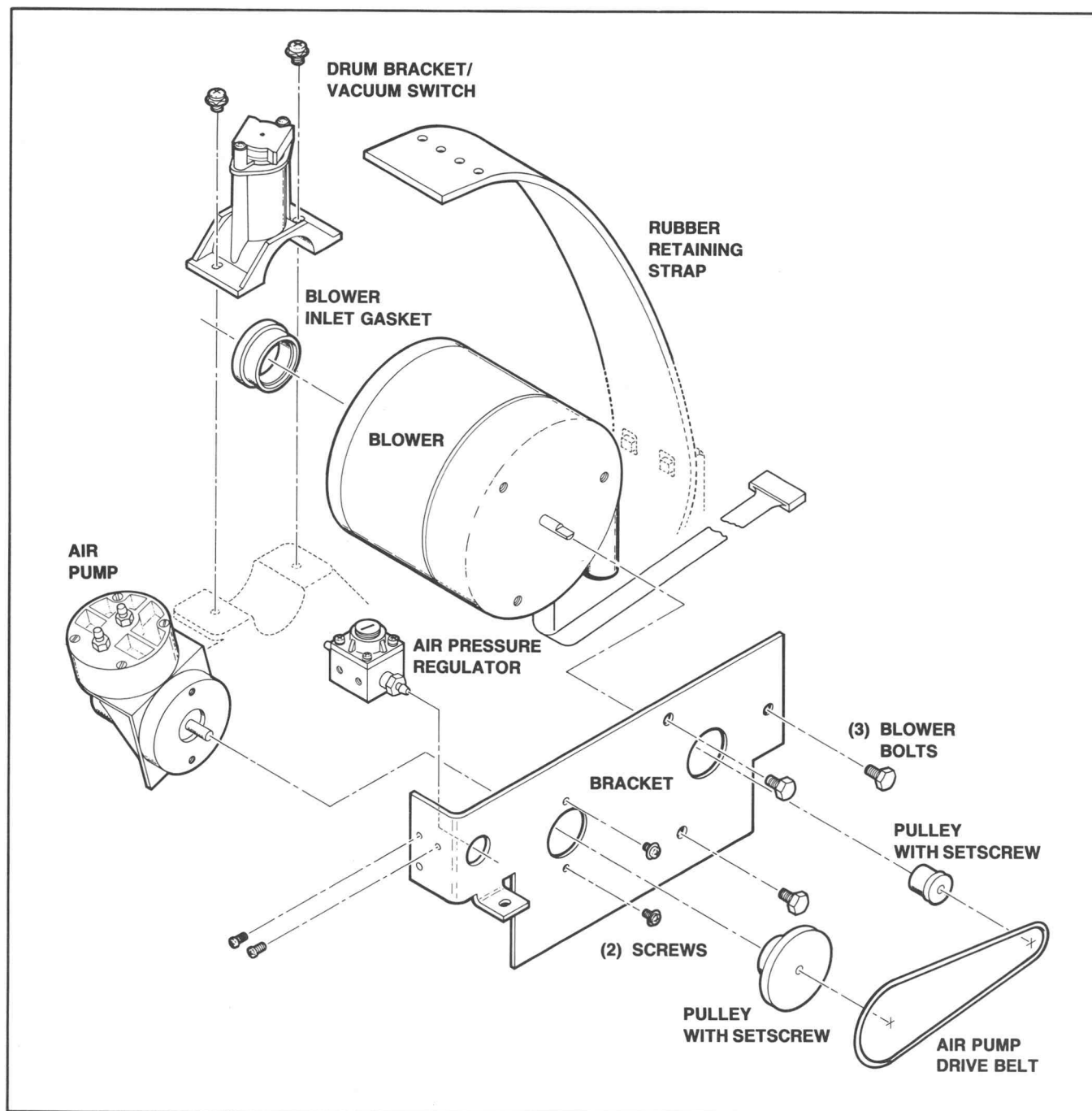


Figure 6-16. Blower Assembly.

6.4.8 REGULATED AIR SYSTEM

The regulated air system provides clean, filtered, regulated, pressurized air to the ink cartridges and the ink-jet heads. This system consists of the air pump, accumulator, regulator, ink cartridge manifold, air valve, an in-line filters, and the ink-jet head manifold. Figure 6-17 shows these components and their interconnections. For a detailed explanation of the system operation read the text in Section 3 "Theory of Operation."

Removal/Replacement

CAUTION

Cleanliness is very important. Whenever detaching an air line, either connect it immediately to the replacement part, or clamp the line to keep any particulate contamination out of the clean air system.

Air Pump. The blower motor provides drive power for the air pump using the pulley/drive belt mounted on the right side of the blower. To remove the air pump:

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover. See Section 6.2.1 "Top Cover."
3. Remove the drive belt connecting the blower motor and the air pump pulley wheels.
4. Using a 5/64" hex driver, remove the pulley wheel from the air pump. Save this wheel for use on the replacement air pump.
5. Clamp and remove the air lines connected to the top of the air pump, and attach them to the replacement pump. Remove the clamps.
6. To access the screws attaching the air pump to the blower/air pump bracket, remove the bracket. Use these steps:
 - a. Remove the rubber retaining strap and screw attaching the blower motor to the bracket. Remove the screws connecting the vacuum switch/drum bracket (which holds the blower inlet).
 - b. Raise the bracket until both of the air pump mounting screws can be reached.
7. Remove the two screws attaching the air pump to the blower/air pump bracket.
8. Attach the replacement air pump to the bracket.
9. Reinstall the blower motor/air pump bracket assembly by reversing the steps in Step 6.
10. Slide the pulley wheel onto the air pump shaft, reinstall the drive belt to the two pulley wheels, check the alignment between the wheels, and tighten the 5/64" set screw in the air pump pulley wheel.

Regulator. Refer to Figure 6-16 to see how the regulator attaches to the blower bracket.

CAUTION

Cleanliness is of utmost importance! Whenever detaching an air line, either connect it immediately to the replacement part, or clamp the line to keep any particulate contamination out of the clean air system.

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover. See Section 6.2.1 "Top Cover."
3. Clamp and detach the air lines connecting to each side of the regulator.
4. Remove the two screws attaching the regulator to the blower bracket.
5. Mount the new regulator to the bracket.
6. Attach the clamped air lines to the new regulator and remove the clamps.
7. Perform the air pressure adjustment procedure found in Section 5.2.1 "Air Pressure."

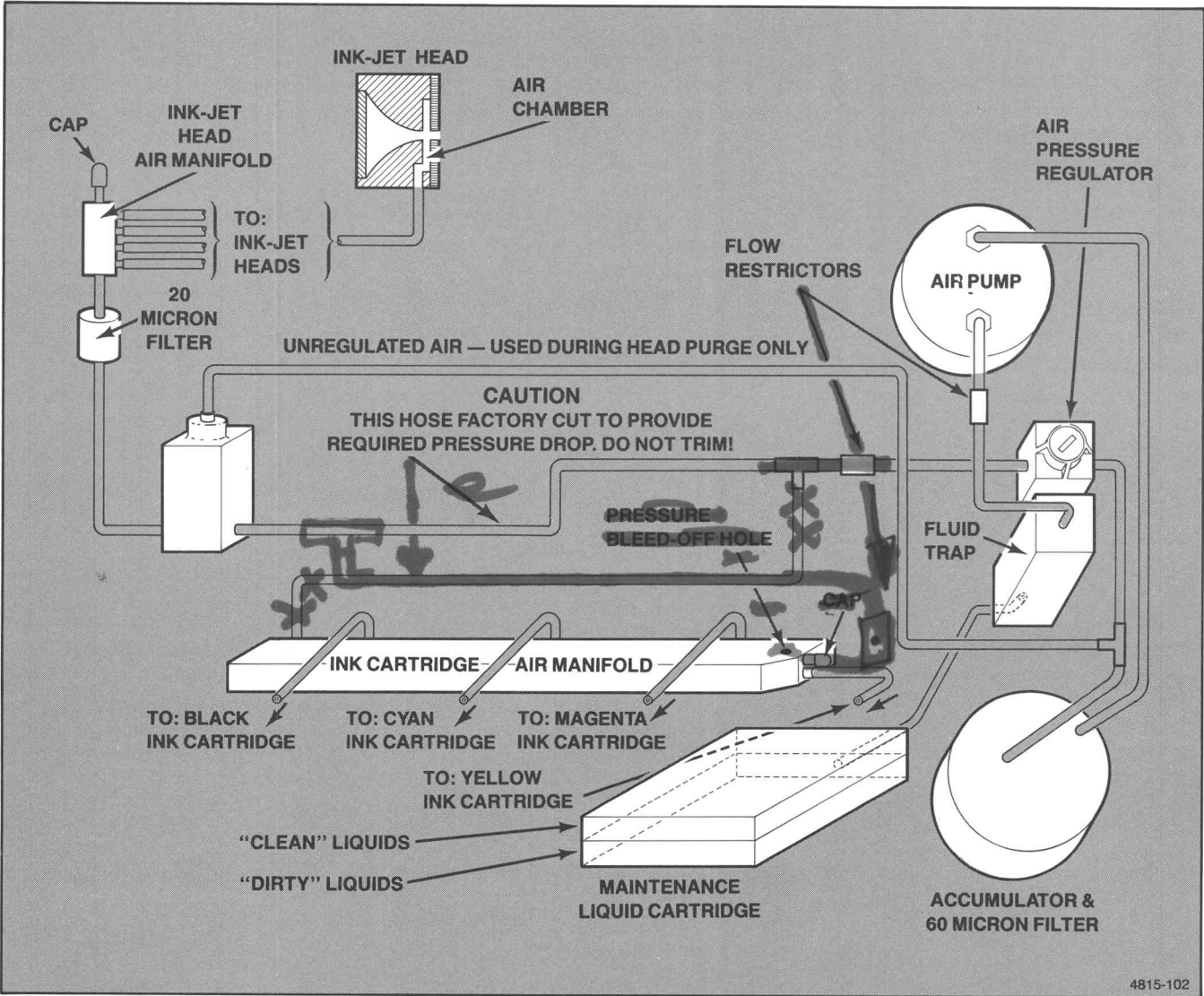


Figure 6-17. Regulated Air System Components.

Air Valve. Refer to Figure 6-17 for this procedure.

CAUTION

Cleanliness is very important. Whenever detaching an air line, either connect it immediately to the replacement part, or clamp the line to keep any particulate contamination out of the clean air system.

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover. See Section 6.2.1 "Top Cover."
3. Remove the two screws holding the air valve in place.
4. Install the replacement air valve. Check that the arrow on the red "override" button of the replacement valve points down.
5. Swap the electrical and air connections from the old air valve to the new air valve.

Accumulator. The accumulator is an enclosed unit containing a 60 micron filter and is sealed with an o-ring. DO NOT wipe out the accumulator cavity unless it contains excess fluid. The o-ring should be checked to ensure a proper seal.

CAUTION

Cleanliness is very important. Whenever detaching an air line, either connect it immediately to the replacement part, or clamp the line to keep any particulate contamination out of the clean air system.

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover. See Section 6.2.1 "Top Cover."
3. Remove the recessed screw in the top of the accumulator cover.
4. Remove the cover and inspect the filter and o-ring. Replace as required.

5. To reassemble, align the o-ring on the lip of the accumulator/filter, align the tab on the accumulator cover with the slot in the top of the accumulator shell.
6. Reinstall and tighten the screw removed in step 3.

6.4.9 FLUFFER ASSEMBLY

The service loop angle bracket, located behind and below the drum assembly, hides the fluffer assembly. The fluffer not only provides an air stream to raise the paper out of the paper tray, but also latches the media input tray in place. Figure 6-18a shows the location of the fluffer and its mounting screws. Figure 6-18b shows an exploded view of the fluffer housing, fluffer solenoid, and tray latches.

Removal/Replacement

You will need a #2 Phillips, magnetic screwdriver with a long tip to remove the fluffer screws — see Figure 6-18.

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover — see Section 6.2.1 "Top Cover."
3. Remove the media input tray.
4. Remove (1) the two angle bracket attaching screws.
5. Remove (2) the two fluffer assembly attaching screws.
6. Disconnect the fluffer solenoid (J27) from the Drive Module board, and release the signal cable from the clamp on the left side of the chassis.
7. The fluffer assembly can now be removed by moving it to the rear, and lifting it out between the circuit board assembly and the angle bracket. You may have to rotate the drum to provide the necessary clearance.
8. To replace the fluffer, reverse these steps. Refer to the procedure for checking and adjusting the fluffer assembly/media input tray — see Section 5.2.4 "Fluffer/Media Load Position."

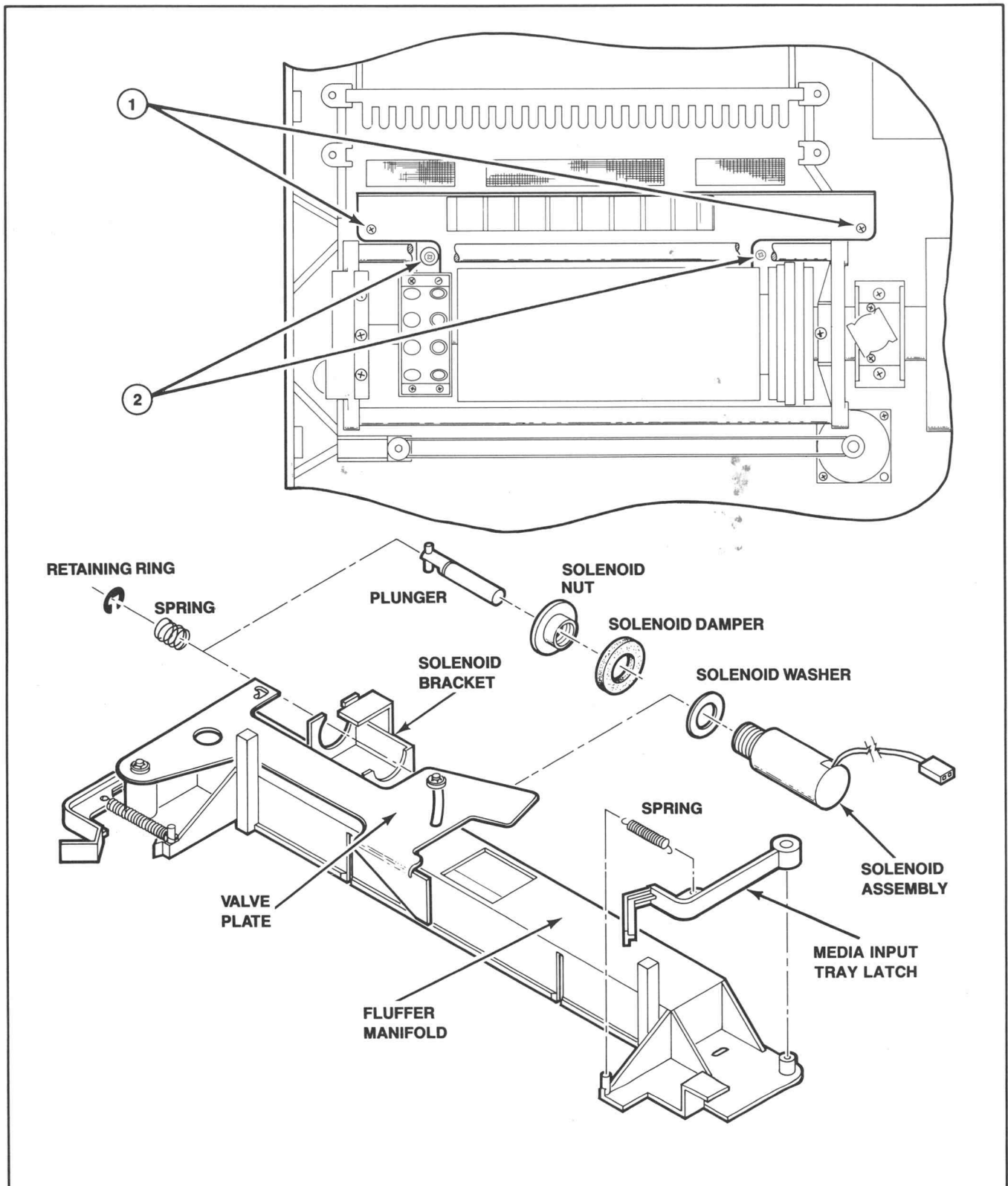


Figure 6-18. Fluffer Assembly.

6.4.10 POWER SUPPLY COMPONENTS

The line voltage components consist of the line voltage selector, transformer, secondary capacitor, and the bridge rectifier. Figure 6-19 shows the connections between these components.



The + 28 volt power supply is active whenever the power cord is connected.

Removal/Replacement

Removing and replacing the components shown in Figure 6-19 is easy. The following information provides helpful hints about each component.

Transformer.

1. Press the POWER OFF switch. When the copier completes the power down sequence, disconnect the power cord from the rear panel.
2. Remove the top cover. See Section 6.2.1 "Top Cover".
3. Disconnect the wires from the line voltage selector and the bridge rectifier.
4. Remove the four screws attaching the transformer to the cabinet bottom. Be sure to save the insulation sleeving surrounding the four transformer mounting screws. Use this sleeving when installing the new transformer.
5. Reverse these steps to replace the transformer.

Secondary Voltage Capacitor.

1. Cut the cable-tie attaching the capacitor to the cabinet bottom.
2. Lift the capacitor up and remove the screws attaching the wires and power resistor to the capacitor.
3. Transfer these wires and power resistor to the replacement capacitor. Ensure the red wire connects to the "+" side of the capacitor and the anode "+" of the diode.

Line Voltage Selector and Line Fuse.

1. Disconnect the wires to the transformer and ground lug.
2. Release the plastic clips on top of the selector and remove the selector through the rear panel.
3. Install the replacement line voltage selector into the back panel.
4. Reinstall the wires from the transformer and ground lug to the line voltage selector — see Figure 6-19.
5. Transfer the fuse from the old line voltage selector to the new line voltage selector. Ensure the selector is set to the correct voltage setting.

Bridge Rectifier.

1. Remove the wires connecting the rectifier to the transformer and transformer capacitor.
2. Remove the nut attaching the rectifier to the rear panel.
3. Attach the new rectifier and reconnect the wires to the new rectifier.

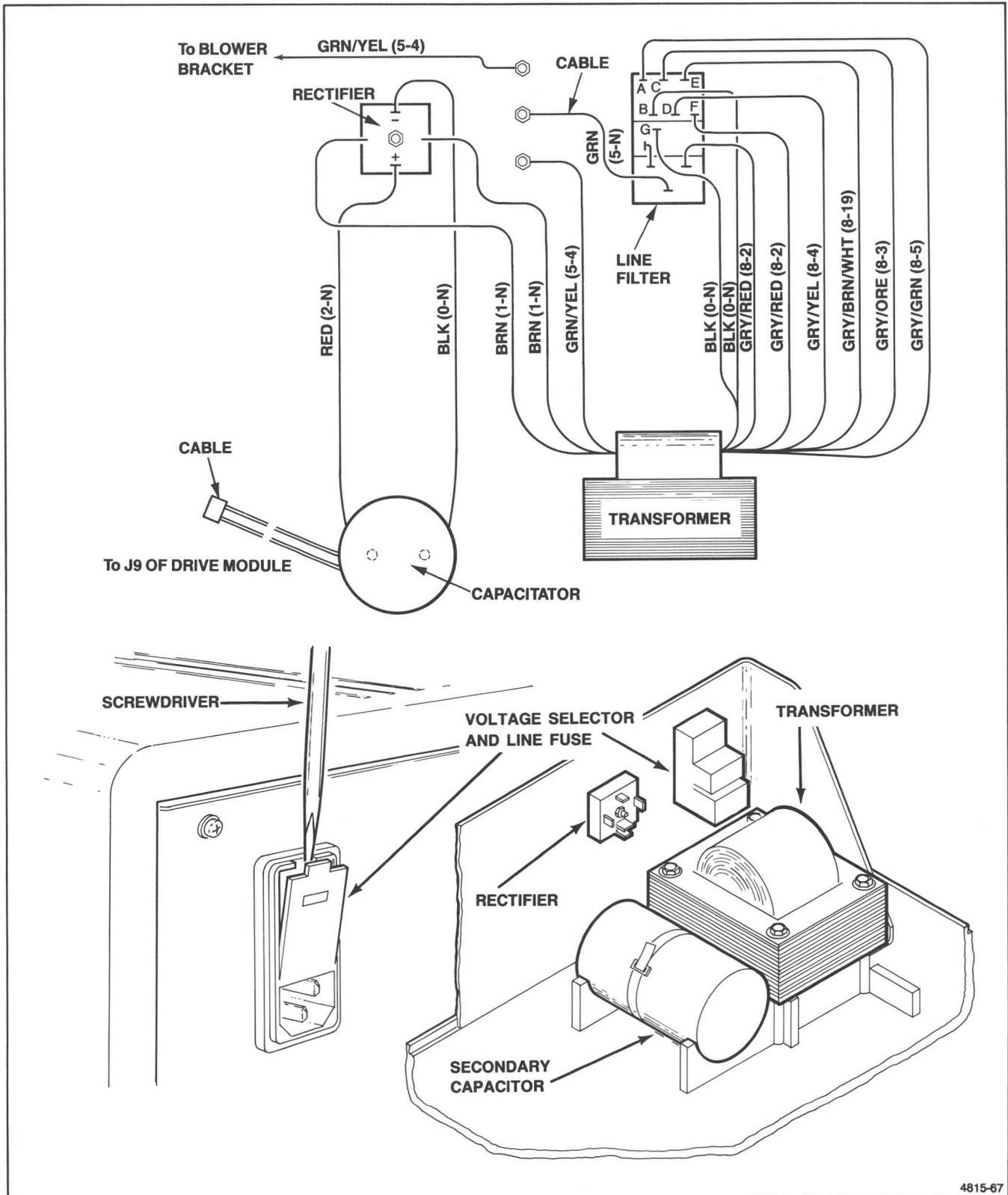


Figure 6-19. Power Supply Components.



Section 7 REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

LIST OF ASSEMBLIES

A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

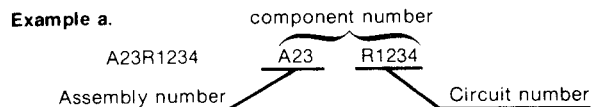
The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

ABBREVIATIONS

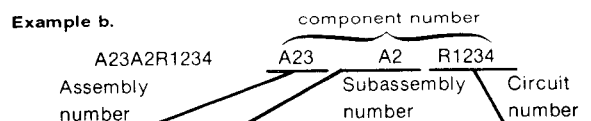
Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:



Read: Resistor 1234 of Assembly 23



Read: Resistor 1234 of Subassembly 2 of Assembly 23

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

TEKTRONIX PART NO. (column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

NAME & DESCRIPTION (column five of the Electrical Parts List)

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

REPLACEABLE ELECTRICAL PARTS

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00213	NYTRONICS, COMPONENTS GROUP, INC., SUBSIDIARY OF NYTRONICS, INC.	ORANGE STREET	DARLINGTON, SC 29532
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P.O. BOX 128	PICKENS, SC 29671
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC.		
	SEMICONDUCTOR GROUP	P.O. BOX 5012	DALLAS, TX 75222
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK P O BOX 867	SYRACUSE, NY 13201 MYRTLE BEACH, SC 29577
04222	AVX CERAMICS, DIVISION OF AVX CORP.	5005 E MCDOWELL RD, PO BOX 20923	PHOENIX, AZ 85036
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	7720 LEMONA AVENUE	VAN NUYS, CA 91405
05464	INDUSTRIAL ELECTRONIC ENGINEERING, INC.		
05828	GENERAL INSTRUMENT CORP ELECTRONIC SYSTEMS DIV.	600 W JOHN ST.	HICKSVILLE LI, NY 11802
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
09023	CORNELL-DUBILIER ELECTRONIC DIVISION FEDERAL PACIFIC ELECTRIC CO.	2652 DALRYMPLE ST. 2035 WABANSIA AVE.	SANFORD, NC 27330 CHICAGO, IL 60647
10389	CHICAGO SWITCH, INC.	8700 E THOMAS RD, P O BOX 1390	SCOTTSDALE, AZ 85252
12954	SIEMENS CORPORATION, COMPONENTS GROUP	3301 ELECTRONICS WAY P O BOX 3049	WEST PALM BEACH, FL 33402
14433	ITT SEMICONDUCTORS	2201 LAURELWOOD DRIVE YOUNG EXPRESSWAY RT 1 INDUSTRIAL PK, P O BOX 280	SANTA CLARA, CA 95054 NEW CUMBERLAND, PA 17070 NORWOOD, MA 02062
17856	SILICONIX, INC.		
22526	BERG ELECTRONICS, INC.	550 HIGH STREET	BRADFORD, PA 16701
24355	ANALOG DEVICES INC.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	2222 WELLINGTON COURT	LISLE, IL 60532
27014	NATIONAL SEMICONDUCTOR CORP.	8081 WALLACE ROAD	EDEN PRAIRIE, MN 55343
27264	MOLEX, INC.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
31918	IEE/SCHADOW INC.	901 THOMPSON PL.	SUNNYVALE, CA 94086
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	640 PAGE MILL ROAD	PALO ALTO, CA 94304
34335	ADVANCED MICRO DEVICES	2820 E COLLEGE AVENUE	STATE COLLEGE, PA 16801
50434	HEWLETT-PACKARD COMPANY	1 PANASONIC WAY	SECAUCUS, NJ 07094
51642	CENTRE ENGINEERING INC.	6435 N PROESEL AVENUE	CHICAGO, IL 60645
54473	MATSUSHITA ELECTRIC, CORP. OF AMERICA	87 MARSHALL ST.	NORTH ADAMS, MA 01247
55680	NICHICON/AMERICA/CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713
56289	SPRAGUE ELECTRIC CO.		
57668	R-OHM CORP.	3400 HILLVIEW AVE	PALO ALTO, CA 94304
58361	GENERAL INSTRUMENT CORP. OPTO ELECTRONICS DIV.	2536 W. UNIVERSITY ST. 644 W. 12TH ST.	ST. LOUIS, MO 63107 ERIE, PA 16512
71400	BUSSMAN MFG., DIVISION OF MCGRAW- EDISON CO.	2500 HARBOR BLVD.	FULLERTON, CA 92634
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.		
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	401 N. BROAD ST. P O BOX 500	PHILADELPHIA, PA 19108 BEAVERTON, OR 97077
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	3029 E. WASHINGTON STREET P. O. BOX 372	INDIANAPOLIS, IN 46206 COLUMBUS, NE 68601
80009	TEKTRONIX, INC.	P. O. BOX 609	SUNNYVALE, CA 94086
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	252 HUMBOLT COURT 1450 JOSUIHON-CHO	KODAIRA-SHI TOKYO, JAPAN
91637	DALE ELECTRONICS, INC.		
T0058	NEC ELECTRON INC.		
T1015	MUSASHI WORKS OF HITACHI LTD		
T1019	SGS-ATES SEMICONDUCTOR CORPORATION	7070 EAST 3RD AVENUE	SCOTTSDALE, AZ 85251

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
CIRCUIT BOARD ASSEMBLIES					
A1	670-8072-00		CKT BOARD ASSY:PARALLEL INTERFACE	80009	670-8072-00
A1	-----		(STANDARD ONLY)		
A1	670-8745-00		CKT BOARD ASSY:PARALLEL INTERFACE	80009	670-8745-00
A1	-----		(OPTION 02 ONLY)		
A2	670-4651-00		CKT BOARD ASSY:FRONT PANEL	80009	670-4651-00
A3	670-8067-00		CKT BOARD ASSY:PROCESS CONTROL	80009	670-8067-00
A4	670-8733-00		CKT BOARD ASSY:DRIVE MODULE	80009	670-8733-00
A5	670-8346-00		CKT BOARD ASSY:INTCON	80009	670-8346-00
A5	-----		(SUBPARTS NOT REPLACEABLE)		
A1 PARALLEL INTERFACE					
A1	670-8072-00		CKT BOARD ASSY:PARALLEL INTERFACE	80009	670-8072-00
A1	-----		(STANDARD ONLY)		
A1	670-8745-00		CKT BOARD ASSY:PARALLEL INTERFACE	80009	670-8745-00
A1	-----		(OPTION 02 ONLY)		
A1C110	290-0804-00		CAP.,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULA1E100TEA
A1C112	290-0746-00		CAP.,FXD,ELCTLT:47UF,+50-10%,16V	55680	ULA1C470TEA
A1C141	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C201	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C251	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C303	281-0814-00		CAP.,FXD,CER DI:100PF,10%,100V	04222	GC101A101K
A1C304	290-0746-00		CAP.,FXD,ELCTLT:47UF,+50-10%,16V	55680	ULA1C470TEA
A1C315	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C341	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C405	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C425	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C435	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C511	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C525	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C525	-----		(OPTION 02 ONLY)		
A1C541	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1C801	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A1CR108	152-0141-02		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A1CR109	152-0141-02		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A1DS460	150-1061-00		LT EMITTING DIO:RED,660NM,50MA MAX	50434	HLMP-1301
A1J63	131-3077-00		CONN,RCPT,ELEC:CKT BD,36 PIN		
A1J65	131-3077-00		CONN,RCPT,ELEC:CKT BD,36 PIN		
A1J65	-----		(OPTION 02 ONLY)		
A1J67	131-3077-00		CONN,RCPT,ELEC:CKT BD,36 PIN		
A1J67	-----		(OPTION 02 ONLY)		
A1J69	131-3077-00		CONN,RCPT,ELEC:CKT BD,36 PIN		
A1J69	-----		(OPTION 02 ONLY)		
A1J511	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J511	-----		(QUANTITY OF 2)		
A1J512	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J512	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J513	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J513	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J514	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J514	-----		(QUANTITY OF 2,OPTION 02 ONLY)		

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A1J515	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J515	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J516	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J516	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J517	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J517	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J518	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J518	-----		(QUANTITY OF 2)		
A1J711	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J711	-----		(QUANTITY OF 2)		
A1J712	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J712	-----		(QUANTITY OF 2)		
A1J713	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J713	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J714	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J714	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J715	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J715	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J716	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J716	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J717	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J717	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1J718	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A1J718	-----		(QUANTITY OF 2,OPTION 02 ONLY)		
A1Q101	151-0342-00		TRANSISTOR:SILICON,PNP	07263	S035928
A1R101	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A1R102	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R103	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R105	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R106	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R107	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R111	315-0303-00		RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A1R112	131-0566-00		BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
A1R135	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R241	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R301	315-0183-00		RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
A1R307	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R317	307-0446-00		RES,NTWK,FXD FI:10K OHM,20%,(9) RES	91637	MSP10A01-103M
A1R351	131-0566-00		BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
A1R352	131-0566-00		BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
A1R357	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R359	315-0201-00		RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
A1R521	307-0486-00		RES,NTWK,FXD,FI:100 OHM,20%,1.125W	01121	210A101
A1R521	-----		(OPTION 02 ONLY)		
A1R525	307-0486-00		RES,NTWK,FXD,FI:100 OHM,20%,1.125W	01121	210A101
A1R525	-----		(OPTION 02 ONLY)		
A1R535	307-0486-00		RES,NTWK,FXD,FI:100 OHM,20%,1.125W	01121	210A101
A1R535	-----		(OPTION 02 ONLY)		
A1R541	307-0486-00		RES,NTWK,FXD,FI:100 OHM,20%,1.125W	01121	210A101
A1R601	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R602	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R602	-----		(OPTION 02 ONLY)		
A1R603	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R603	-----		(OPTION 02 ONLY)		

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A2 FRONT PANEL					
A2	670-4651-00		CKT BOARD ASSY:FRONT PANEL	80009	670-4651-00
A2C101	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A2DS111	150-1070-00		LT EMITTING DIO:RED,635NM,35A MAX	58361	MV57124
A2DS112	150-1070-00		LT EMITTING DIO:RED,635NM,35A MAX	58361	MV57124
A2DS121	150-1070-00		LT EMITTING DIO:RED,635NM,35A MAX	58361	MV57124
A2DS122	150-1070-00		LT EMITTING DIO:RED,635NM,35A MAX	58361	MV57124
A2DS132	150-1109-00		LT EMITTING DIO:GREEN, 30MA	73138	SP732
A2DS133	150-1073-00		LT EMITTING DIO:YELLOW,585NM,35MA MAX	05464	LLM3124Y
A2DS142	150-1109-00		LT EMITTING DIO:GREEN, 30MA	73138	SP732
A2DS211	150-1073-00		LT EMITTING DIO:YELLOW,585NM,35MA MAX	05464	LLM3124Y
A2DS212	150-1073-00		LT EMITTING DIO:YELLOW,585NM,35MA MAX	05464	LLM3124Y
A2DS221	150-1073-00		LT EMITTING DIO:YELLOW,585NM,35MA MAX	05464	LLM3124Y
A2DS222	150-1073-00		LT EMITTING DIO:YELLOW,585NM,35MA MAX	05464	LLM3124Y
A2DS233	150-1070-00		LT EMITTING DIO:RED,635NM,35A MAX	58361	MV57124
A2DS234	150-1070-00		LT EMITTING DIO:RED,635NM,35A MAX	58361	MV57124
A2J75	131-3103-00		TERM SET,PIN:DBL ROW,RIGHT ANGLE,MALE		
A2R131	307-0347-00		RES.,FXD,FILM:13 RES NETWORK	73138	899-1-R220
A2R143	315-0101-00		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A2R331	307-0675-00		RES NTWK,FXD FI:(9)1K OHM,2% 1.25W	01121	210A102
A2S141	260-2072-00		SWITCH,PUSH:SPST,10MA,35VDC,MOMENTARY	31918	532.000.001
A2S151	260-2072-00		SWITCH,PUSH:SPST,10MA,35VDC,MOMENTARY	31918	532.000.001
A2S241	260-2072-00		SWITCH,PUSH:SPST,10MA,35VDC,MOMENTARY	31918	532.000.001
A2S251	260-2072-00		SWITCH,PUSH:SPST,10MA,35VDC,MOMENTARY	31918	532.000.001
A2S333	260-1470-00		SWITCH,SLIDE:DPDT,0.5A,125VAC	10389	23-021-309
A2S334	260-1470-00		SWITCH,SLIDE:DPDT,0.5A,125VAC	10389	23-021-309
A2S341	260-2072-00		SWITCH,PUSH:SPST,10MA,35VDC,MOMENTARY	31918	532.000.001
A2S351	260-2072-00		SWITCH,PUSH:SPST,10MA,35VDC,MOMENTARY	31918	532.000.001
A2U301	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A2U311	156-0913-02		MICROCIRCUIT,DI:OCTAL D FF,BURN-IN	04713	SN74LS377NDS
A2U312	156-1221-00		MICROCIRCUIT,DI:HEX D-TYPE FF,SCRN	01295	SN74LS378NP3
A2U322	156-0438-00		MICROCIRCUIT,DI:TTL,OCTAL BUFFERS & LINE		

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A3 PROCESS CONTROL					
A3	670-8067-00		CKT BOARD ASSY:PROCESS CONTROL	80009	670-8067-00
A3C101	290-0526-00		CAP.,FXD,ELCTLT:6.8UF,20%,6V	90201	TDC685M00NLE
A3C102	283-0210-00		CAP.,FXD,CER DI:0.0056UF,20%,50V	56289	273C9
A3C131	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C143	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C201	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C206	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A3C301	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C304	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C311	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C321	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C331	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C341	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C403	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C421	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C441	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C515	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C521	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C531	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C543	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C547	290-0746-00		CAP.,FXD,ELCTLT:47UF, +50-10%,16V	55680	ULA1C470TEA
A3C605	290-0746-00		CAP.,FXD,ELCTLT:47UF, +50-10%,16V	55680	ULA1C470TEA
A3C621	281-0865-00		CAP.,FXD,CER DI:1000PF,5%,100V	04222	MA201A102JAA
A3C641	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C707	281-0865-00		CAP.,FXD,CER DI:1000PF,5%,100V	04222	MA201A102JAA
A3C708	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C714	281-0819-00		CAP.,FXD,CER DI:33PF,5%,50V	72982	8035BC0G330
A3C716	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C718	281-0819-00		CAP.,FXD,CER DI:33PF,5%,50V	72982	8035BC0G330
A3C724	281-0819-00		CAP.,FXD,CER DI:33PF,5%,50V	72982	8035BC0G330
A3C727	281-0819-00		CAP.,FXD,CER DI:33PF,5%,50V	72982	8035BC0G330
A3C728	290-0526-00		CAP.,FXD,ELCTLT:6.8UF,20%,6V	90201	TDC685M00NLE
A3C729	290-0530-00		CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
A3C744	283-0785-00		CAP.,FXD,MICA D:250PF,1%,500V	09023	CD15FD251F03
A3C745	283-0660-00		CAP.,FXD,MICA D:510PF,2%,500V	00853	D155F511G0
A3C813	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C823	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C843	283-0421-00		CAP.,FXD,CER DI:0.1UF, +80-20%,50V	04222	DG015E104Z
A3C845	290-0526-00		CAP.,FXD,ELCTLT:6.8UF,20%,6V	90201	TDC685M00NLE
A3CR215	152-0141-02		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A3CR216	152-0141-02		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A3DS402	150-1061-00		LT EMITTING DIO:RED,660NM,50MA MAX	50434	HLMP-1301
A3J43	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A3J43	-----		(QUANTITY OF 7)		
A3J45	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A3J45	-----		(QUANTITY OF 26)		
A3J51	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A3J51	-----		(QUANTITY OF 4)		
A3J53	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A3J53	-----		(QUANTITY OF 19)		
A3Q203	151-0190-00		TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
A3R101	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A1R604	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R604	-----		(OPTION 02 ONLY)		
A1R605	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R605	-----		(OPTION 02 ONLY)		
A1R606	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R606	-----		(OPTION 02 ONLY)		
A1R607	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R607	-----		(OPTION 02 ONLY)		
A1R608	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R711	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R712	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R713	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R713	-----		(OPTION 02 ONLY)		
A1R714	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R714	-----		(OPTION 02 ONLY)		
A1R715	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R715	-----		(OPTION 02 ONLY)		
A1R716	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R716	-----		(OPTION 02 ONLY)		
A1R717	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R717	-----		(OPTION 02 ONLY)		
A1R718	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A1R718	-----		(OPTION 02 ONLY)		
A1R811	315-0203-00		RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A1R811	-----		(OPTION 02 ONLY)		
A1R812	315-0203-00		RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A1R812	-----		(OPTION 02 ONLY)		
A1R813	315-0203-00		RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A1R813	-----		(OPTION 02 ONLY)		
A1R814	315-0203-00		RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A1U115	156-1205-00		MICROCIRCUIT,DI:PERIPHERAL INTFC ADAPTER	04713	MC68B21P OR L
A1U121	160-3019-01		MICROCIRCUIT,DI:OCTAL 10 INPUT AND/OR IN		
A1U125	160-2988-00		MICROCIRCUIT,DI:PARALLEL INTFC,PRGM	80009	160-2988-00
A1U135	156-0956-02		MICROCIRCUIT,DI:OCTAL BFR W/3 STATE OUT	01295	SN74LS244NP3
A1U141	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A1U145	156-0385-02		MICROCIRCUIT,DI:HEX INVERTER	01295	SN74LS04
A1U201	156-1335-00		MICROCIRCUIT,DI:DUAL RETRIG RESET MONO MV	07263	96LS02
A1U205	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A1U231	156-1594-00		MICROCIRCUIT,DI:2048 X 8 SRAM	T1015	HM6116P-3(DP-24)
A1U241	156-1594-00		MICROCIRCUIT,DI:2048 X 8 SRAM	T1015	HM6116P-3(DP-24)
A1U251	160-3014-01		MICROCIRCUIT,DI:4096 X 8 EPROM,PRGM		
A1U261	156-1065-01		MICROCIRCUIT,DI:OCTAL D TYPE TRANS LATCHES	34335	AM74LS373
A1U301	160-2287-00		MICROCIRCUIT,DI:LOGIC ARRAY,PRGM	80009	160-2287-00
A1U305	156-0391-02		MICROCIRCUIT,DI:HEX LATCH W/CLEAR	01295	SN74LS174
A1U315	156-1969-00		MICROCIRCUIT,DI:HMOS,HIGH DENSITY N-CHANNEL		
A1U325	156-1458-00		MICROCIRCUIT,DI:DMA CONTROLLER	04713	MC6844 P OR L
A1U331	160-3015-01		MICROCIRCUIT,DI:8192 X 8 EPROM,PRGM		
A1U331	160-3016-01		MICROCIRCUIT,DI:8192 X 8 EPROM,PRGM		
A1U331	-----		(OPTION 02 ONLY)		
A1U335	156-1065-01		MICROCIRCUIT,DI:OCTAL D TYPE TRANS LATCHES	34335	AM74LS373
A1U341	156-1839-00		MICROCIRCUIT,DI:OCTAL BIDIRECTIONAL		
A1U351	156-0438-00		MICROCIRCUIT,DI:TTL,OCTAL BUFFERS & LINE		
A1U405	160-3099-00		MICROCIRCUIT,DI:LOGIC ARRAY,PRGM		
A1U405	-----		(STANDARD ONLY)		
A1U405	160-2288-00		MICROCIRCUIT,DI:LOGIC ARRAY,PRGM	80009	160-2288-00

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A1U405	-----		(OPTION 02 ONLY)		
A1U411	156-0913-02		MICROCIRCUIT,DI:OCTAL D FF,BURN-IN	04713	SN74LS377NDS
A1U421	156-0438-00		MICROCIRCUIT,DI:TTL,OCTAL BUFFERS & LINE		
A1U425	156-0956-02		MICROCIRCUIT,DI:OCTAL BFR W/3 STATE OUT	01295	SN74LS244NP3
A1U431	156-0438-00		MICROCIRCUIT,DI:TTL,OCTAL BUFFERS & LINE		
A1U435	156-0982-03		MICROCIRCUIT,DI:OCTAL-D-EDGE FF,SCRN	01295	SN74LS374 N3
A1U441	156-0852-02		MICROCIRCUIT,DI:HEX DRVR W/3 STATE INP	01295	SN74LS367NP3
A1U511	156-1740-00		MICROCIRCUIT,DI:OCTAL DYNAMIC MEM DRIVER	34335	AM2966DCB
A1U521	156-0982-03		MICROCIRCUIT,DI:OCTAL-D-EDGE FF,SCRN	01295	SN74LS374 N3
A1U521	-----		(OPTION 02 ONLY)		
A1U525	156-0982-03		MICROCIRCUIT,DI:OCTAL-D-EDGE FF,SCRN	01295	SN74LS374 N3
A1U525	-----		(OPTION 02 ONLY)		
A1U535	156-0982-03		MICROCIRCUIT,DI:OCTAL-D-EDGE FF,SCRN	01295	SN74LS374 N3
A1U535	-----		(OPTION 02 ONLY)		
A1U541	156-0982-03		MICROCIRCUIT,DI:OCTAL-D-EDGE FF,SCRN	01295	SN74LS374 N3
A1U601	156-0390-02		MICROCIRCUIT,DI:DUAL 4/2 LINE DCDR/DEMUX	01295	SN74LS155
A1U611	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A1U611	-----		(OPTION 02 ONLY)		
A1U701	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A1U801	156-1740-00		MICROCIRCUIT,DI:OCTAL DYNAMIC MEM DRIVER	34335	AM2966DCB
A1U805	156-0955-02		MICROCIRCUIT,DI:OCTAL BFR W/3 STATE OUT	04713	SN74LS241
A1W231	131-0566-00		BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A3R105	307-0998-00		RES.,NTWK,FXD,FI:7.5.6K OHM,2%,1.0W	01121	208A562
A3R115	307-0595-00		RES NTWK,FXD FI:7.5.6K OHM,2%,1.0W	32997	4308R-101-562
A3R117	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A3R145	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A3R201	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A3R202	321-0153-00		RES.,FXD,FILM:383 OHM,1%,0.125W	91637	MFF1816G383R0F
A3R206	321-0005-00		RES.,FXD,FILM:11 OHM,1%,0.125W	75042	CEAT0-11R0F
A3R208	321-0049-00		RES.,FXD,FILM:31.6 OHM,1%,0.125W	91637	MFF1816G31R60F
A3R301	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A3R302	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A3R305	315-0824-00		RES.,FXD,CMPSN:820K OHM,5%,0.25W	01121	CB8245
A3R401	315-0391-00		RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A3R404	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A3R431	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A3R501	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A3R613	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A3R623	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A3R705	311-1236-00		RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	72-22-0
A3R709	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A3R710	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A3R711	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A3R712	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A3R719	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A3R720	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A3R721	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A3R722	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A3R727	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A3R728	321-0242-00		RES.,FXD,FILM:3.24K OHM,1%,0.125W	91637	MFF1816G32400F
A3R730	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A3R731	321-0331-00		RES.,FXD,FILM:27.4K OHM,1%,0.125W	91637	MFF1816G27401F
A3R732	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A3R733	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A3R734	315-0364-00		RES.,FXD,CMPSN:360K OHM,5%,0.25W	01121	CB3645
A3R735	315-0364-00		RES.,FXD,CMPSN:360K OHM,5%,0.25W	01121	CB3645
A3R736	315-0244-00		RES.,FXD,CMPSN:240K OHM,5%,0.25W	01121	CB2445
A3R737	315-0244-00		RES.,FXD,CMPSN:240K OHM,5%,0.25W	01121	CB2445
A3R738	315-0204-00		RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
A3R739	315-0204-00		RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
A3R740	321-0331-00		RES.,FXD,FILM:27.4K OHM,1%,0.125W	91637	MFF1816G27401F
A3R741	307-0650-00		RES NTWK,FXD,FI:9.2.7K OHM,5%,0.150W	32997	4310R-101-272
A3R744	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A3R801	311-1236-00		RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	72-22-0
A3R803	311-1236-00		RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	72-22-0
A3R805	311-1236-00		RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	72-22-0
A3R807	321-0140-00		RES.,FXD,FILM:280 OHM,1%,0.125W	91637	MFF1816G280R0F
A3R814	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A3R818	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A3R824	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A3R827	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A3R828	321-0058-00		RES.,FXD,FILM:39.2 OHM,1%,0.125W	91637	MFF1816G39R20F
A3R841	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A3TP327	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A3TP404	214-0579-00		TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A3TP805	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A3U101	156-0513-00		MICROCIRCUIT,DI:8-CHAN MUX	80009	156-0513-00
A3U111	156-1205-00		MICROCIRCUIT,DI:PERIPHERAL INTFC ADAPTER	04713	MC68B21P OR L
A3U121	156-1969-00		MICROCIRCUIT,DI:H MOS,HIGH DENSITY N-CHAN		
A3U125	156-1065-01		MICROCIRCUIT,DI:OCTAL D TYPE TRANS LATCHES	34335	AM74LS373
A3U131	156-1550-00		MICROCIRCUIT,DI:SYSTEM TIMING CONTROLLER	34335	AM9513(PCTB OR D
A3U141	156-0392-03		MICROCIRCUIT,DI:QUAD LATCH W/CLEAR	01295	SN74S175NP3
A3U143	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A3U201	156-1225-01		MICROCIRCUIT,DI:DUAL COMPARATOR,SCREENED	27014	LM393N/A +
A3U225	156-0985-01		MICROCIRCUIT,DI:DUAL 5 INPUT NOR GATE,SCRN	04713	SN74LS260
A3U241	160-2579-00		MICROCIRCUIT,DI:PROCESS CONTROL,PRGM	80009	160-2579-00
A3U243	156-1921-00		MICROCIRCUIT,DI:OCTAL BUS TRANSCEIVER		
A3U301	156-1335-00		MICROCIRCUIT,DI:DUAL RETRIG RESET MONO MV	07263	96LS02
A3U311	160-3020-01		MICROCIRCUIT,DI:16384 X 8 EPROM,PRGM		
A3U321	160-3018-01		MICROCIRCUIT,DI:2048 X 8 EPROM,PRGM		
A3U325	156-0982-03		MICROCIRCUIT,DI:DUAL D-EDGE FF,SCRN	01295	SN74LS374 N3
A3U331	156-0716-00		MICROCIRCUIT,DI:RAM,128 X 8 STATIC	04713	MCM6810S
A3U341	156-0844-02		MICROCIRCUIT,DI:SYN 4 BIT CNTR,SCRN	01295	SN74LS161A
A3U343	156-0865-02		MICROCIRCUIT,DI:OCTAL D-TYPE FF W/CLEAR	01295	SN74LS273NP3
A3U411	156-0385-02		MICROCIRCUIT,DI:HEX INVERTER	01295	SN74LS04
A3U415	156-0844-02		MICROCIRCUIT,DI:SYN 4 BIT CNTR,SCRN	01295	SN74LS161A
A3U421	156-0530-02		MICROCIRCUIT,DI:QUAD 2-INP MUX,SCRN	01295	SN74LS157P3
A3U425	156-0383-02		MICROCIRCUIT,DI:QUAD 2-INP NOR GATE	01295	SN74LS02
A3U431	156-0381-02		MICROCIRCUIT,DI:QUAD 2-INP EXCL OR GATE	01295	SN74LS86
A3U441	156-0844-02		MICROCIRCUIT,DI:SYN 4 BIT CNTR,SCRN	01295	SN74LS161A
A3U443	156-0412-02		MICROCIRCUIT,DI:SYN 4 BIT UP/DOWN CNTR	01295	SN74LS193N3
A3U511	156-0865-02		MICROCIRCUIT,DI:OCTAL D-TYPE FF W/CLEAR	01295	SN74LS273NP3
A3U515	160-2580-00		MICROCIRCUIT,DI:PROCESS CONTROL,PRGM	80009	160-2580-00
A3U521	156-0914-02		MICROCIRCUIT,DI:OCT ST BFR W/3 STATE OUT	01295	SN74LS240
A3U525	156-1059-01		MICROCIRCUIT,DI:DUAL J-K EDGE TRIGGERED	01295	SN74LS109A
A3U531	156-1205-00		MICROCIRCUIT,DI:PERIPHERAL INTFC ADAPTER	04713	MC68B21P OR L
A3U541	156-0392-03		MICROCIRCUIT,DI:QUAD LATCH W/CLEAR	01295	SN74S175NP3
A3U543	156-0386-02		MICROCIRCUIT,DI:TRIPLE 3-INP NAND GATE	27014	DM74LS10N
A3U611	156-0383-02		MICROCIRCUIT,DI:QUAD 2-INP NOR GATE	01295	SN74LS02
A3U615	156-1059-01		MICROCIRCUIT,DI:DUAL J-K EDGE TRIGGERED	01295	SN74LS109A
A3U621	156-0480-02		MICROCIRCUIT,DI:QUAD 2 INP & GATE	01295	SN74LS08NP3
A3U625	156-0875-02		MICROCIRCUIT,DI:DUAL 2-W/2 INP AOI GATES	01295	SN74LS51
A3U641	156-0392-03		MICROCIRCUIT,DI:QUAD LATCH W/CLEAR	01295	SN74S175NP3
A3U643	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A3U713	156-1367-00		MICROCIRCUIT,LI:8 BIT BUFF,MULT D/A CONV	24355	AD11/297
A3U715	156-1191-00		MICROCIRCUIT,LI:BI-FET OPNL AMPL	01295	TL072ACP
A3U717	156-1367-00		MICROCIRCUIT,LI:8 BIT BUFF,MULT D/A CONV	24355	AD11/297
A3U723	156-1367-00		MICROCIRCUIT,LI:8 BIT BUFF,MULT D/A CONV	24355	AD11/297
A3U725	156-1191-00		MICROCIRCUIT,LI:BI-FET OPNL AMPL	01295	TL072ACP
A3U727	156-1367-00		MICROCIRCUIT,LI:8 BIT BUFF,MULT D/A CONV	24355	AD11/297
A3U741	156-1994-00		MICROCIRCUIT,DI:CMOS,OCTAL BUFFERS & LINE		
A3U743	156-0975-02		MICROCIRCUIT,DI:UNIV SHIFT/STORAGE RGTR	01295	SN74LS299N3/J4
A3U745	156-1149-00		MICROCIRCUIT,DI:OPERATIONAL AMP,JFET INPUT	27014	GLEA134
A3U813	156-0391-02		MICROCIRCUIT,DI:HEX LATCH W/CLEAR	01295	SN74LS174
A3U817	156-0865-02		MICROCIRCUIT,DI:OCTAL D-TYPE FF W/CLEAR	01295	SN74LS273NP3
A3U823	156-0391-02		MICROCIRCUIT,DI:HEX LATCH W/CLEAR	01295	SN74LS174
A3U827	156-0865-02		MICROCIRCUIT,DI:OCTAL D-TYPE FF W/CLEAR	01295	SN74LS273NP3
A3U831	160-3017-01		MICROCIRCUIT,DI:2048 X 8 EPROM,PRGM		
A3U841	156-0975-02		MICROCIRCUIT,DI:UNIV SHIFT/STORAGE RGTR	01295	SN74LS299N3/J4
A3U843	156-0975-02		MICROCIRCUIT,DI:UNIV SHIFT/STORAGE RGTR	01295	SN74LS299N3/J4

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A3U845	156-0975-02		MICROCIRCUIT,DI:UNIV SHIFT/STORAGE RGTR	01295	SN74LS299N3/J4
A3VR214	152-0175-00		SEMICON D DEVICE:ZENER,0.4W,5.6V,5%	04713	SZG35008
A3Y401	158-0287-00		XTAL UNIT,QTZ:4MHZ,0.1%,SERIES		

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4 DRIVE MODULE					
A4	670-8733-00		CKT BOARD ASSY:DRIVE MODULE	80009	670-8733-00
A4C151	281-0773-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C153	281-0773-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C155	290-0990-00		CAP.,FXD,ELCTLT:10UF,20%,50V		
A4C157	290-0512-00		CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
A4C161	290-0990-00		CAP.,FXD,ELCTLT:10UF,20%,50V		
A4C171	290-0901-00		CAP.,FXD,ELCTLT: 800UF,+50-10%,50V	56289	674D807H050JJ5A
A4C251	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A4C271	283-0059-00		CAP.,FXD,CER DI:1UF,+80-20%,50V	51642	400050Z5U105Z
A4C351	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A4C361	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A4C393	281-0819-00		CAP.,FXD,CER DI:33PF,5%,50V	72982	8035BC0G330
A4C451	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A4C461	290-0946-00		CAP.,FXD,ELCTLT:270UF,10+100%,40V	90201	VPR271N040E1E1C
A4C477	281-0865-00		CAP.,FXD,CER DI:1000PF,5%,100V	04222	MA201A102JAA
A4C485	281-0865-00		CAP.,FXD,CER DI:1000PF,5%,100V	04222	MA201A102JAA
A4C495	281-0865-00		CAP.,FXD,CER DI:1000PF,5%,100V	04222	MA201A102JAA
A4C571	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C573	281-0773-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C575	283-0059-00		CAP.,FXD,CER DI:1UF,+80-20%,50V	51642	400050Z5U105Z
A4C583	281-0865-00		CAP.,FXD,CER DI:1000PF,5%,100V	04222	MA201A102JAA
A4C584	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C585	281-0773-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C593	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C653	281-0773-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C655	281-0865-00		CAP.,FXD,CER DI:1000PF,5%,100V	04222	MA201A102JAA
A4C657	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C661	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C671	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C675	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C677	290-0535-00		CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
A4C682	281-0865-00		CAP.,FXD,CER DI:1000PF,5%,100V	04222	MA201A102JAA
A4C691	290-0526-00		CAP.,FXD,ELCTLT:6.8UF,20%,6V	90201	TDC685M00NLE
A4C692	290-0534-00		CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
A4C696	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C751	283-0059-00		CAP.,FXD,CER DI:1UF,+80-20%,50V	51642	400050Z5U105Z
A4C753	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C755	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C757	290-0945-00		CAP.,FXD,ELCTLT:840UF,10+100%,12V	90201	VPR841N012E1E1C
A4C759	290-0845-00		CAP.,FXD,ELCTLT:330UF,10+50%,25 WVDC	55680	ULB1E331TEAANA
A4C761	290-0901-00		CAP.,FXD,ELCTLT: 800UF,+50-10%,50V	56289	674D807H050JJ5A
A4C765	283-0059-00		CAP.,FXD,CER DI:1UF,+80-20%,50V	51642	400050Z5U105Z
A4C773	281-0815-00		CAP.,FXD,CER DI:0.027UF,20%,50V	72982	8005D9AABW5R273M
A4C774	290-0512-00		CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
A4C775	290-0845-00		CAP.,FXD,ELCTLT:330UF,10+50%,25 WVDC	55680	ULB1E331TEAANA
A4C776	290-0845-00		CAP.,FXD,ELCTLT:330UF,10+50%,25 WVDC	55680	ULB1E331TEAANA
A4C781	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C787	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C788	290-0845-00		CAP.,FXD,ELCTLT:330UF,10+50%,25 WVDC	55680	ULB1E331TEAANA
A4C789	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C792	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C799	290-0845-00		CAP.,FXD,ELCTLT:330UF,10+50%,25 WVDC	55680	ULB1E331TEAANA

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4C851	290-0844-00		CAP.,FXD,ELCTLT:100UF,-10+75%,35 WVDC	54473	ECE-A35V100L
A4C855	290-0844-00		CAP.,FXD,ELCTLT:100UF,-10+75%,35 WVDC	54473	ECE-A35V100L
A4C861	290-0946-00		CAP.,FXD,ELCTLT:270UF,10+100%,40V	90201	VPR271N040E1E1C
A4C873	290-0512-00		CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
A4C875	290-0512-00		CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
A4C877	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C883	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C885	290-0512-00		CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
A4C889	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C893	290-0512-00		CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
A4C895	281-0775-00		CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C896	290-0512-00		CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
A4CR171	152-0398-00		SEMICONV DEVICE:SILICON,200V,1A	04713	SR3609RL
A4CR175	152-0754-00		SEMICONV DEVICE:RECT,SI,SCHOTTKY,40V,8A	80009	152-0754-00
A4CR181	152-0198-00		SEMICONV DEVICE:SILICON,200V,3A	03508	1N5624
A4CR185	152-0198-00		SEMICONV DEVICE:SILICON,200V,3A	03508	1N5624
A4CR190	152-0754-00		SEMICONV DEVICE:RECT,SI,SCHOTTKY,40V,8A	80009	152-0754-00
A4CR191	152-0754-00		SEMICONV DEVICE:RECT,SI,SCHOTTKY,40V,8A	80009	152-0754-00
A4CR195	152-0198-00		SEMICONV DEVICE:SILICON,200V,3A	03508	1N5624
A4CR361	152-0075-00		SEMICONV DEVICE:SW,GE,22V,40MA	14433	G866
A4CR391	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR475	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR479	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR483	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR485	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR493	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR495	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR585	152-0141-02		SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A4CR591	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR592	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR593	152-0066-00		SEMICONV DVC DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A4CR594	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR696	152-0141-02		SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A4CR751	152-0836-00		SEMICONV DEVICE:RECTIFIER,SI,1A,40V	04713	MBR140P
A4CR761	152-0754-00		SEMICONV DEVICE:RECT,SI,SCHOTTKY,40V,8A	80009	152-0754-00
A4CR782	152-0141-02		SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A4CR785	152-0141-02		SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A4CR786	152-0141-02		SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A4CR787	152-0141-02		SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	01295	1N4152R
A4CR851	152-0398-00		SEMICONV DEVICE:SILICON,200V,1A	04713	SR3609RL
A4CR855	152-0398-00		SEMICONV DEVICE:SILICON,200V,1A	04713	SR3609RL
A4F271	159-0188-00		FUSE,CARTRIDGE:3AG,8A,125VAC,FAST BLOW	71400	GLH-8
A4F571	159-0188-00		FUSE,CARTRIDGE:3AG,8A,125VAC,FAST BLOW	71400	GLH-8
A4F661	159-0021-00		FUSE,CARTRIDGE:3AG,2A,250V,FAST-BLOW	71400	AGC 2
A4F761	159-0021-00		FUSE,CARTRIDGE:3AG,2A,250V,FAST-BLOW	71400	AGC 2
A4F851	159-0090-00		FUSE,CARTRIDGE:0.25A,125V,FAST-BLOW	71400	GFA 1/4
A4F855	159-0090-00		FUSE,CARTRIDGE:0.25A,125V,FAST-BLOW	71400	GFA 1/4
A4J9	131-2182-00		TERM. SET,PIN:1 X 5.0,156 SPACING,RTANG	27264	09-47-1052
A4J11	131-3272-00		CONN,RCPT,ELEC:HEADER,1 X 6,0.1 SPACING		
A4J13	131-3170-00		CONN,RCPT,ELEC:MOLEX,8 MALE,0.156		
A4J15	131-3271-00		CONN,RCPT,ELEC:HEADER 1 X 4,0.1 SPACING		
A4J17	131-3270-00		CONN,RCPT,ELEC:MOLEX,8 MALE,0.156		
A4J21	131-3271-00		CONN,RCPT,ELEC:HEADER 1 X 4,0.1 SPACING		
A4J23	131-3273-00		CONN,RCPT,ELEC:HEADER,1 X 8,0.1 SPACING		

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4J25	131-0589-00		TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
A4J25	-----		(QUANTITY OF 2)		
A4J27	131-3270-00		CONN,RCPT,ELEC:MOLEX,8 MALE,0.156		
A4J29	131-3270-00		CONN,RCPT,ELEC:MOLEX,8 MALE,0.156		
A4J31	131-3271-00		CONN,RCPT,ELEC:HEADER 1 X 4,0.1 SPACING		
A4J33	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4J33	-----		(QUANTITY OF 10)		
A4J785	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4J785	-----		(QUANTITY OF 9)		
A4L175	276-0541-00		SHIELDING BEAD,:	80009	276-0541-00
A4L190	276-0541-00		SHIELDING BEAD,:	80009	276-0541-00
A4L191	276-0541-00		SHIELDING BEAD,:	80009	276-0541-00
A4L751	108-0554-00		COIL,RF:5UH	80009	108-0554-00
A4L761	276-0541-00		SHIELDING BEAD,:	80009	276-0541-00
A4Q151	151-0785-00		TRANSISTOR:DARLINGTON,NPN,SI		
A4Q155	151-0785-00		TRANSISTOR:DARLINGTON,NPN,SI		
A4Q161	151-0785-00		TRANSISTOR:DARLINGTON,NPN,SI		
A4Q165	151-0785-00		TRANSISTOR:DARLINGTON,NPN,SI		
A4Q167	151-0190-00		TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
A4Q171	151-0621-00		TRANSISTOR:SILICON,NPN	03508	X44H382
A4Q175	151-0621-00		TRANSISTOR:SILICON,NPN	03508	X44H382
A4Q181	151-0621-00		TRANSISTOR:SILICON,NPN	03508	X44H382
A4Q185	151-0621-00		TRANSISTOR:SILICON,NPN	03508	X44H382
A4Q191	151-0621-00		TRANSISTOR:SILICON,NPN	03508	X44H382
A4Q195	151-0621-00		TRANSISTOR:SILICON,NPN	03508	X44H382
A4Q271	151-0622-00		TRANSISTOR:SILICON,PNP		
A4Q275	151-0622-00		TRANSISTOR:SILICON,PNP		
A4Q281	151-0622-00		TRANSISTOR:SILICON,PNP		
A4Q285	151-0622-00		TRANSISTOR:SILICON,PNP		
A4Q291	151-0622-00		TRANSISTOR:SILICON,PNP		
A4Q295	151-0622-00		TRANSISTOR:SILICON,PNP		
A4Q393	151-0622-00		TRANSISTOR:SILICON,PNP		
A4Q471	151-0188-00		TRANSISTOR:PNP,SI,TO-92	T0058	2N3906
A4Q473	151-0465-00		TRANSISTOR:SILICON,PNP	04713	SJE797K
A4Q475	151-0466-00		TRANSISTOR:SILICON,NPN	04713	SJE327
A4Q481	151-0188-00		TRANSISTOR:PNP,SI,TO-92	T0058	2N3906
A4Q483	151-0465-00		TRANSISTOR:SILICON,PNP	04713	SJE797K
A4Q485	151-0466-00		TRANSISTOR:SILICON,NPN	04713	SJE327
A4Q487	151-0465-00		TRANSISTOR:SILICON,PNP	04713	SJE797K
A4Q491	151-0188-00		TRANSISTOR:PNP,SI,TO-92	T0058	2N3906
A4Q495	151-0466-00		TRANSISTOR:SILICON,NPN	04713	SJE327
A4Q581	151-0465-00		TRANSISTOR:SILICON,PNP	04713	SJE797K
A4Q585	151-0465-00		TRANSISTOR:SILICON,PNP	04713	SJE797K
A4Q591	151-0465-00		TRANSISTOR:SILICON,PNP	04713	SJE797K
A4Q595	151-0622-00		TRANSISTOR:SILICON,PNP		
A4Q651	151-1006-00		TRANSISTOR:SILICON,JFE,N-CHANNEL	17856	FN686
A4Q779	151-1066-00		TRANSISTOR:SILICON,FE,P-CHANNEL	27014	SF88025
A4Q855	151-0521-00		SCR:SI,MU-27	03508	C122B
A4Q861	151-0621-00		TRANSISTOR:SILICON,NPN	03508	X44H382
A4Q865	151-0622-00		TRANSISTOR:SILICON,PNP		
A4R151	308-0739-00		RES.,FXD,WW:4 OHM,1%,3W	00213	1240S
A4R152	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A4R153	308-0739-00		RES.,FXD,WW:4 OHM,1%,3W	00213	1240S
A4R155	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4R161	307-0928-00		RES.,NTWK,FXD,FI:10%,0.5W		
A4R181	308-0828-00		RES.,FXD,WW:0.1 OHM,1%,3W	91637	RS-2B-ER1000F
A4R191	308-0828-00		RES.,FXD,WW:0.1 OHM,1%,3W	91637	RS-2B-ER1000F
A4R251	307-0596-00		RES NTWK,FXD FI:7.2.2K OHM,2%,1.0W	91637	MSP08A01222G
A4R255	321-0294-00		RES.,FXD,FILM:11.3K OHM,1%,0.125W	91637	CMF55116G11301F
A4R261	321-0228-00		RES.,FXD,FILM:2.32K OHM,1%,0.125W	91637	MFF1816G23200F
A4R271	308-0764-00		RES.,FXD,WW:2.7 OHM,5%,2W	75042	BWF-2R700J
A4R275	308-0314-00		RES.,FXD,WW:680 OHM,5%,3W	91637	CW2B 680R0J
A4R281	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A4R282	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R283	315-0100-00		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A4R284	315-0100-00		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A4R285	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R286	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A4R287	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A4R288	308-0314-00		RES.,FXD,WW:680 OHM,5%,3W	91637	CW2B 680R0J
A4R291	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R293	315-0100-00		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A4R294	308-0503-00		RES.,FXD,WW:6.8 OHM,5%,2.50W	91637	CW2B-D6R800J
A4R295	308-0314-00		RES.,FXD,WW:680 OHM,5%,3W	91637	CW2B 680R0J
A4R297	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R361	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R391	307-0675-00		RES NTWK,FXD FI:(9)1K OHM,2% 1.25W	01121	210A102
A4R393	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R395	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R451	307-0596-00		RES NTWK,FXD FI:7.2.2K OHM,2%,1.0W	91637	MSP08A01222G
A4R471	301-0272-00		RES.,FXD,CMPSN:2.7K OHM,5%,0.5W	01121	EB2725
A4R472	315-0100-00		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A4R473	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R475	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A4R477	315-0150-00		RES.,FXD,CMPSN:15 OHM,5%,0.25W	01121	CB1505
A4R478	301-0272-00		RES.,FXD,CMPSN:2.7K OHM,5%,0.5W	01121	EB2725
A4R479	308-0463-00		RES.,FXD,WW:0.3 OHM,1%,3W	91637	RS2B-KR3000F
A4R480	315-0100-00		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A4R481	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R483	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A4R485	315-0150-00		RES.,FXD,CMPSN:15 OHM,5%,0.25W	01121	CB1505
A4R487	301-0272-00		RES.,FXD,CMPSN:2.7K OHM,5%,0.5W	01121	EB2725
A4R488	315-0100-00		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A4R489	308-0463-00		RES.,FXD,WW:0.3 OHM,1%,3W	91637	RS2B-KR3000F
A4R491	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R493	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A4R495	315-0150-00		RES.,FXD,CMPSN:15 OHM,5%,0.25W	01121	CB1505
A4R496	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A4R499	308-0463-00		RES.,FXD,WW:0.3 OHM,1%,3W	91637	RS2B-KR3000F
A4R551	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A4R555	307-0596-00		RES NTWK,FXD FI:7.2.2K OHM,2%,1.0W	91637	MSP08A01222G
A4R571	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A4R573	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A4R575	321-0318-00		RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
A4R577	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A4R581	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A4R582	315-0152-00		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
A4R583	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4R584	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A4R585	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A4R586	315-0153-00		RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A4R591	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A4R592	315-0624-00		RES.,FXD,CMPSN:620K OHM,5%,0.25W	01121	CB6245
A4R593	315-0474-00		RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
A4R595	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A4R651	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A4R653	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A4R655	315-0391-00		RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A4R657	315-0303-00		RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A4R659	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A4R661	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A4R663	321-0285-00		RES.,FXD,FILM:9.09K OHM,1%,0.125W	91637	MFF1816G90900F
A4R665	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A4R667	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A4R669	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A4R671	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A4R672	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A4R673	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R674	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R675	315-0753-00		RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
A4R676	315-0154-00		RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
A4R677	315-0304-00		RES.,FXD,CMPSN:300K OHM,5%,0.25W	01121	CB3045
A4R678	315-0624-00		RES.,FXD,CMPSN:620K OHM,5%,0.25W	01121	CB6245
A4R679	315-0753-00		RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
A4R681	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A4R682	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R683	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A4R684	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R685	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A4R686	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A4R687	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A4R688	321-0222-00		RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A4R689	321-0222-00		RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A4R691	315-0391-00		RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A4R692	321-0164-00		RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816G499R0F
A4R693	321-0161-00		RES.,FXD,FILM:464 OHM,1%,0.125W	91637	MFF1816G464R0F
A4R694	321-0215-00		RES.,FXD,FILM:1.69K OHM,1%,0.125W	91637	MFF1816G16900F
A4R695	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R696	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A4R697	315-0824-00		RES.,FXD,CMPSN:820K OHM,5%,0.25W	01121	CB8245
A4R698	315-0753-00		RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
A4R699	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R751	308-0582-00		RES.,FXD,WW:0.025 OHM,1%,2W		
A4R771	315-0154-00		RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
A4R772	315-0304-00		RES.,FXD,CMPSN:300K OHM,5%,0.25W	01121	CB3045
A4R773	315-0624-00		RES.,FXD,CMPSN:620K OHM,5%,0.25W	01121	CB6245
A4R774	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R775	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R776	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A4R777	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R781	321-0756-00		RES.,FXD,FILM:50K OHM,1%,0.125W	24546	NA55D5002F
A4R782	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025

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Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4R783	321-0356-00		RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
A4R784	321-0356-00		RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
A4R785	321-0356-00		RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
A4R786	321-0297-00		RES.,FXD,FILM:12.1K OHM,1%,0.125W	91637	MFF1816G12101F
A4R787	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A4R791	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A4R792	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A4R793	321-0104-00		RES.,FXD,FILM:118 OHM,1%,0.125W	01121	ORD BY DESCR
A4R794	321-0288-00		RES.,FXD,FILM:9.76K OHM,1%,0.125W	91637	MFF1816G97600F
A4R795	321-0340-00		RES.,FXD,FILM:34K OHM,1%,0.125W	91637	CMF55116G34001F
A4R796	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A4R797	315-0391-00		RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A4R798	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R855	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A4R861	301-0621-00		RES.,FXD,CMPSN:620 OHM,5%,0.50W	57668	NTR501E620E
A4R863	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A4R865	315-0100-00		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A4R871	307-0937-00		RES.,FXD,FILM:1.8 OHM,0.5W,2%,CARBON		
A4R873	307-0937-00		RES.,FXD,FILM:1.8 OHM,0.5W,2%,CARBON		
A4R875	321-0215-00		RES.,FXD,FILM:1.69K OHM,1%,0.125W	91637	MFF1816G16900F
A4R877	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A4R881	321-0215-00		RES.,FXD,FILM:1.69K OHM,1%,0.125W	91637	MFF1816G16900F
A4R883	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A4R885	307-0937-00		RES.,FXD,FILM:1.8 OHM,0.5W,2%,CARBON		
A4R887	321-0215-00		RES.,FXD,FILM:1.69K OHM,1%,0.125W	91637	MFF1816G16900F
A4R889	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A4R891	307-0937-00		RES.,FXD,FILM:1.8 OHM,0.5W,2%,CARBON		
A4R893	321-0215-00		RES.,FXD,FILM:1.69K OHM,1%,0.125W	91637	MFF1816G16900F
A4R895	321-0134-00		RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A4T861	120-1551-00		XFMR,PWR,STPDN:FLYBACK HIGH FREQUENCY		
A4T871	120-1552-00		XFMR,PWR:HIGH FREQUENCY,DRIVER,POT CORE		
A4T881	120-1552-00		XFMR,PWR:HIGH FREQUENCY,DRIVER,POT CORE		
A4T885	120-1552-00		XFMR,PWR:HIGH FREQUENCY,DRIVER,POT CORE		
A4T891	120-1552-00		XFMR,PWR:HIGH FREQUENCY,DRIVER,POT CORE		
A4TP461	214-0579-00		TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A4TP581	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4TP671	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4TP672	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4TP772	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4TP773	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4TP774	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4TP894	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4TP895	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4TP896	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4TP897	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
A4U151	156-0853-00		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,DUAL	27014	LM358N
A4U161	156-0513-00		MICROCIRCUIT,DI:8-CHAN MUX	80009	156-0513-00
A4U250	156-0514-00		MICROCIRCUIT,DI:DIFF 4-CHAN MUX	80009	156-0514-00
A4U251	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A4U255	156-0514-00		MICROCIRCUIT,DI:DIFF 4-CHAN MUX	80009	156-0514-00
A4U257	156-0391-02		MICROCIRCUIT,DI:HEX LATCH W/CLEAR	01295	SN74LS174
A4U261	156-0513-00		MICROCIRCUIT,DI:8-CHAN MUX	80009	156-0513-00
A4U265	156-0381-02		MICROCIRCUIT,DI:QUAD 2-INP EXCL OR GATE	01295	SN74LS86
A4U351	156-0438-00		MICROCIRCUIT,DI:TTL,OCTAL BUFFERS & LINE		

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4U355	156-0865-02		MICROCIRCUIT,DI:OCTAL D-TYPE FF W/CLEAR	01295	SN74LS273NP3
A4U361	160-2289-00		MICROCIRCUIT,DI:LOGIC ARRAY,PRGM	80009	160-2289-00
A4U371	156-1926-00		MICROCIRCUIT,DI:DUAL PERIPHERAL POS-NAND		
A4U373	156-1926-00		MICROCIRCUIT,DI:DUAL PERIPHERAL POS-NAND		
A4U375	156-0440-00		MICROCIRCUIT,DI:DUAL PERIPHERAL POSITIVE		
A4U377	156-0440-00		MICROCIRCUIT,DI:DUAL PERIPHERAL POSITIVE		
A4U381	156-0440-00		MICROCIRCUIT,DI:DUAL PERIPHERAL POSITIVE		
A4U383	156-0440-00		MICROCIRCUIT,DI:DUAL PERIPHERAL POSITIVE		
A4U387	160-2578-00		MICROCIRCUIT,DI:DRIVE MODULE,PRGM	80009	160-2578-00
A4U391	156-1994-00		MICROCIRCUIT,DI:CMOS,OCTAL BUFFERS & LILNE		
A4U451	156-0957-01		MICROCIRCUIT,DI:SYN 4 BIT UP/DOWN BINARY	27014	DM74LS169
A4U455	156-0720-02		MICROCIRCUIT,DI:HEX DRVR,4 TO 2 LINE	01295	SN74LS368
A4U461	156-0957-01		MICROCIRCUIT,DI:SYN 4 BIT UP/DOWN BINARY	27014	DM74LS169
A4U551	156-0957-01		MICROCIRCUIT,DI:SYN 4 BIT UP/DOWN BINARY	27014	DM74LS169
A4U555	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A4U561	156-0957-01		MICROCIRCUIT,DI:SYN 4 BIT UP/DOWN BINARY	27014	DM74LS169
A4U571	156-0411-00		MICROCIRCUIT,LI:QUAD-COMP,SGL SUPPLY	27014	LM339N
A4U581	156-1926-00		MICROCIRCUIT,DI:DUAL PERIPHERAL POS-NAND		
A4U585	156-1926-00		MICROCIRCUIT,DI:DUAL PERIPHERAL POS-NAND		
A4U591	156-1631-00		MICROCIRCUIT,LI:ADJ SHUNT REGULATOR	01295	TL431C-LP
A4U651	156-1627-00		MICROCIRCUIT,LI:POWER WIDTH MODULATED CONT	01295	TL594CN
A4U671	156-0495-00		MICROCIRCUIT,LI:OPNL AMPL	27014	LM324N
A4U681	156-0411-00		MICROCIRCUIT,LI:QUAD-COMP,SGL SUPPLY	27014	LM339N
A4U691	156-1335-00		MICROCIRCUIT,DI:DUAL RETRIG RESET MONO MV	07263	96LS02
A4U771	156-0515-00		MICROCIRCUIT,DI:TRIPLE 3-CHAN MUX	80009	156-0515-00
A4U871	156-1760-00		MICROCIRCUIT,LI:POWER AMPLIFIER	T1019	TDA2030H
A4U881	156-1760-00		MICROCIRCUIT,LI:POWER AMPLIFIER	T1019	TDA2030H
A4U886	156-1760-00		MICROCIRCUIT,LI:POWER AMPLIFIER	T1019	TDA2030H
A4U891	156-1760-00		MICROCIRCUIT,LI:POWER AMPLIFIER	T1019	TDA2030H
A4VR495	152-0281-00		SEMICONV DEVICE:ZENER,0.4W,22V,5%	12954	1N969B
A4VR796	152-0514-00		SEMICONV DEVICE:ZENER,0.4W,10V,1%	80009	152-0514-00
A4VR797	152-0175-00		SEMICONV DEVICE:ZENER,0.4W,5.6V,5%	04713	SZG35008
A4VR857	152-0175-00		SEMICONV DEVICE:ZENER,0.4W,5.6V,5%	04713	SZG35008
.					
.					
.					
A5	670-8346-00		CKT BOARD ASSY:INTCON	80009	670-8346-00
A5	-----		(SUBPARTS NOT REPLACEABLE)		

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
CHASSIS PARTS					
B1001	147-0060-00		MOTOR,DC:1.8 DEG STEP ANGLE,200 STEP		
B1002	-----		MOTOR,DC:(NOT AVAILABLE)		
B1003	119-0336-00		FAN,CENTRIFUGAL:24V,100W MAX,8000 RPM		
B1004	119-1733-00		PUMP:WASHER		
C1001	283-0179-00		CAP.,FXD,CER DI:0.68UF,10%,100V	56289	3C37X5R684K100B
C1002	290-1025-00		CAP.,FXD,ELCTLT:22000UF,40V		
CR1001	152-0475-01		SEMICON DVC,DI:RECT,SI,50V,12A DIODE		
F5001	159-0026-00		FUSE,CARTRIDGE:3AG,3.2A,125V,SLOW-BLOW	71400	MDX 3 2/10
F5001	-----		(STANDARD ONLY)		
F5001	159-0003-00		FUSE,CARTRIDGE:3AG,1.6A,250V,SLOW-BLOW	71400	MDX 1 6/10
F5001	-----		(OPTIONS A1,A2,A3,A4 AND A5 ONLY)		
FL1001	119-1816-00		FILTER,LINE:VOLTAGE SELECTOR W/RECEPT		
L1001	214-3582-00		VALVE,AIR:2VDC,10-32 FITTING TO 0.125		
L1002	119-1702-00		SOLENOID,ELEC:20VDC,14W		
L1003	119-0504-00		SOLENOID,ELEC:PLUNGER		
R1001	308-0393-00		RES.,FXD,WW:1.6K OHM,5%,3W	91637	CW2B-16000J-T/R
S1013	260-2172-00		SWITCH,PRESSURE:120VAC,20MA,160HZ		
T1001	120-1553-00		XFMR,PWR,STPDN:LOW FREQUENCY		
U1015	156-2219-01		MICROCIRCUIT,LI:OPTICAL INTERRUPTER		
U1015	-----		(HOME SWITCH W/LEADS)		
U1017	156-2219-00		MICROCIRCUIT,LI:OPTICAL INTERRUPTER		
U1017	-----		(DOOR SWITCH W/LEADS)		



Section 8

DIAGRAMS AND SCHEMATICS

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μ F).

Resistors = Ohms (Ω).

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

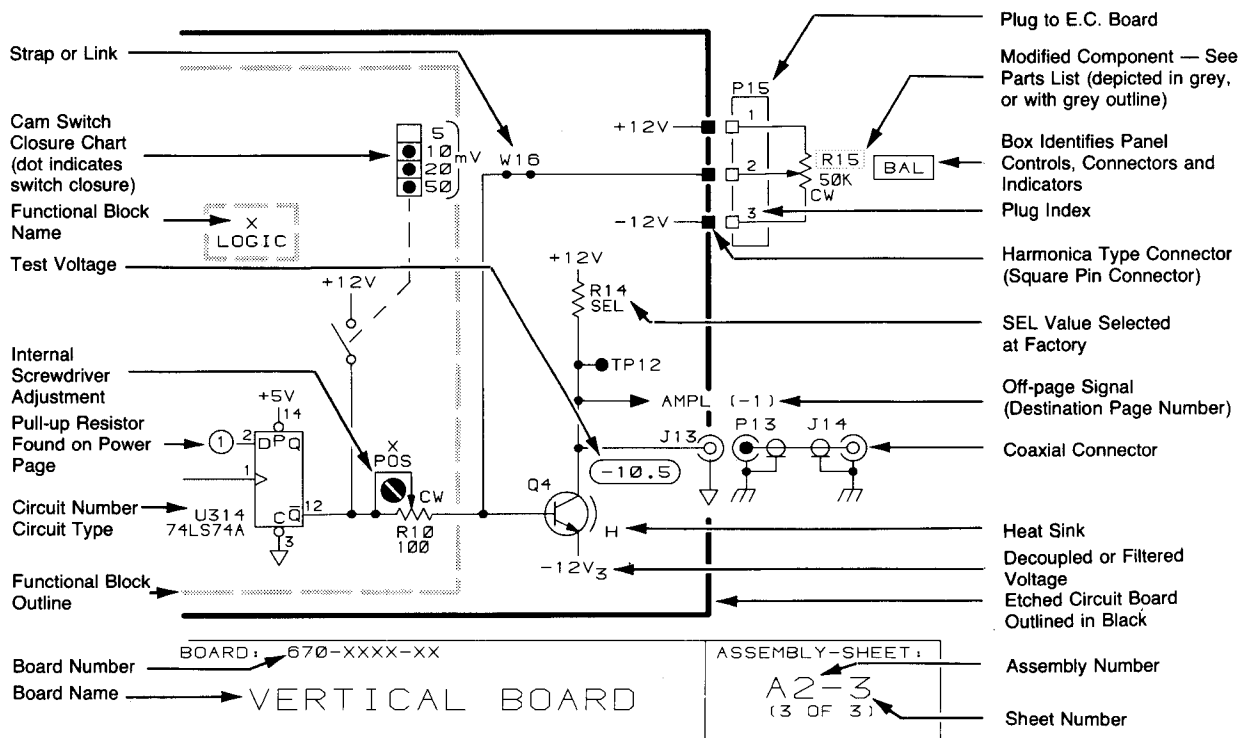
Abbreviations are based on ANSI Y1.1-1972. Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc., are:

Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	H	Heat dissipating device (heat sink, heat radiator, etc.)	S	Switch or contactor
AT	Attenuator, fixed or variable	HR	Heater	T	Transformer
B	Motor	HY	Hybrid circuit	TC	Thermocouple
BT	Battery	J	Connector, stationary portion	TP	Test point
C	Capacitor, fixed or variable	K	Relay	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CB	Circuit breaker	L	Inductor, fixed or variable	V	Electron tube
CR	Diode, signal or rectifier	M	Meter	VR	Voltage regulator (zener diode, etc.)
DL	Delay line	P	Connector, movable portion	W	Wirestrap or cable
DS	Indicating device (lamp)	Q	Transistor or silicon-controlled rectifier	Y	Crystal
E	Spark Gap, Ferrite bead	R	Resistor, fixed or variable	Z	Phase shifter
F	Fuse	RT	Thermistor		
FL	Filter				

The following special symbols may appear on the diagrams:



DIAGRAMS AND SCHEMATICS

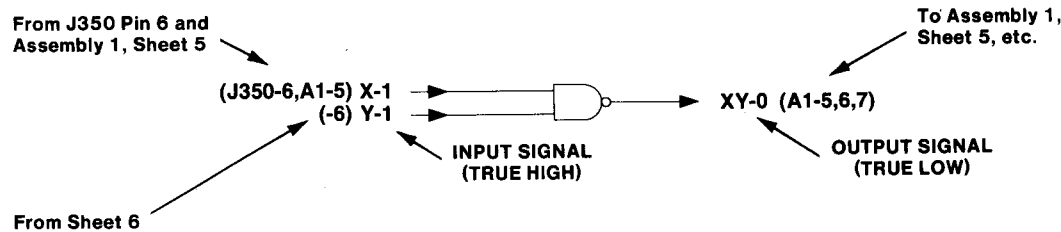
1. True High and True Low Signals

Signal names on the schematics are followed by -1 or a -0. A TRUE HIGH signal is indicated by -1, and a TRUE LOW signal is indicated by -0.

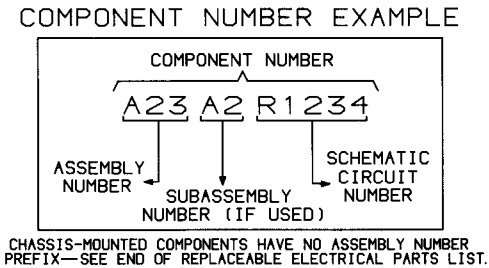
SIGNAL -1 = TRUE HIGH
SIGNAL -0 = TRUE LOW

2. Cross-References

Schematic cross-references (from/to information) are included on the schematics. The "from" reference only indicates the signal "source," and the "to" reference lists all loads where the signal is used. All from/to information will be enclosed in parentheses.



3. Component Number Example



Section 9

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

```

1 2 3 4 5           Name & Description
Assembly and/or Component
Attaching parts for Assembly and/or Component
    --- * ---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
    --- * ---
Parts of Detail Part
Attaching parts for Parts of Detail Part
    --- * ---
  
```

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol --- * --- indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ABBREVIATIONS

#	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
ACTR	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ADPTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICON	SEMICONDUCTOR
ALIGN	ALIGNMENT	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
AL	ALUMINUM	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
ASSEM	ASSEMBLED	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSY	ASSEMBLY	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ATTEN	ATTENUATOR	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
AWG	AMERICAN WIRE GAGE	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVEING
BD	BOARD	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BRKT	BRACKET	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRS	BRASS	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRZ	BRONZE	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BSHG	BUSHING	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
CAB	CABINET	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAP	CAPACITOR	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CER	CERAMIC	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CHAS	CHASSIS	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CKT	CIRCUIT	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
COMP	COMPOSITION	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
CONN	CONNECTOR	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
COV	COVER	HLXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
CPLG	COUPLING	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CRT	CATHODE RAY TUBE	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
DEG	DEGREE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DWR	DRAWER	IDNT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
		IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

REPLACEABLE MECHANICAL PARTS

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000AH	STANDARD PRESSED STEEL CO., UNBRAKO DIV.	8535 DICE ROAD	SANTA FE SPRINGS, CA 90670
000FF	LEWIS SCREW	4114 SOUTH PEORIA AVE.	CHICAGO, IL 60609
000GY	DEK INC.	3480 SWENSEN AVE.	ST. CHARLES, IL 60174
000JA	J. PHILLIP INDUSTRIES INC.	5713 NORTHWEST HIGHWAY	CHICAGO, ILL 60646
00779	AMP, INC.	P.O. BOX 3608	HARRISBURG, PA 17105
04963	MINNESOTA MINING AND MFG. CO., ADHESIVES COATINGS AND SEALERS DIVISION	3M CENTER	ST. PAUL, MN 55101
06383	PANDUIT CORPORATION	17301 RIDGELAND	TINLEY PARK, IL 60477
07111	PNEUMO DYNAMICS CORPORATION	4800 PRUDENTIAL TOWER	BOSTON, MA 02199
09922	BURNDY CORPORATION	RICHARDS AVENUE	NORWALK, CT 06852
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
34785	DEK INC.	1555 HAWTHORNE LN.	W CHICAGO, IL 60185
52152	MINNESOTA MINING AND MFG CO.	INDUSTRIAL SPECIALTIES DIV. 3M CENTER	ST. PAUL, MN 55144
72228	CONTINENTAL SCREW CO., DIV. OF AMTEL, INC.	459 MT. PLEASANT	NEW BEDFORD, MA 02742
74970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	WASECA, MN 56093
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
78553	EATON CORPORATION, ENGINEERED FASTENERS DIVISION, TINNEMAN PLANT	PO BOX 6688, 8700 BROOKPARK RD.	CLEVELAND, OH 44101
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
86445	PENN FIBRE AND SPECIALTY CO., INC.	2032 E. WESTMORELAND ST.	PHILADELPHIA, PA 19134
95987	WECKESSER CO., INC.	4444 WEST IRVING PARK RD.	CHICAGO, IL 60641
S3109	C/O PANEL COMPONENTS CORP.	P.O. BOX 6626	SANTA ROSA, CA 95406
T0435	LEWIS SCREW CO.	4114 SOUTH PERORIA AVE.	CHICAGO, IL 60609
T1105	J PHILLIP INDUSTRIES INC	5713 NORTHWEST HIGHWAY	CHICAGO, IL 60646
T1372	ELECTRI-CORD MFG CO INC	312 E. MAIN ST.	WESTFIELD, PA 16950

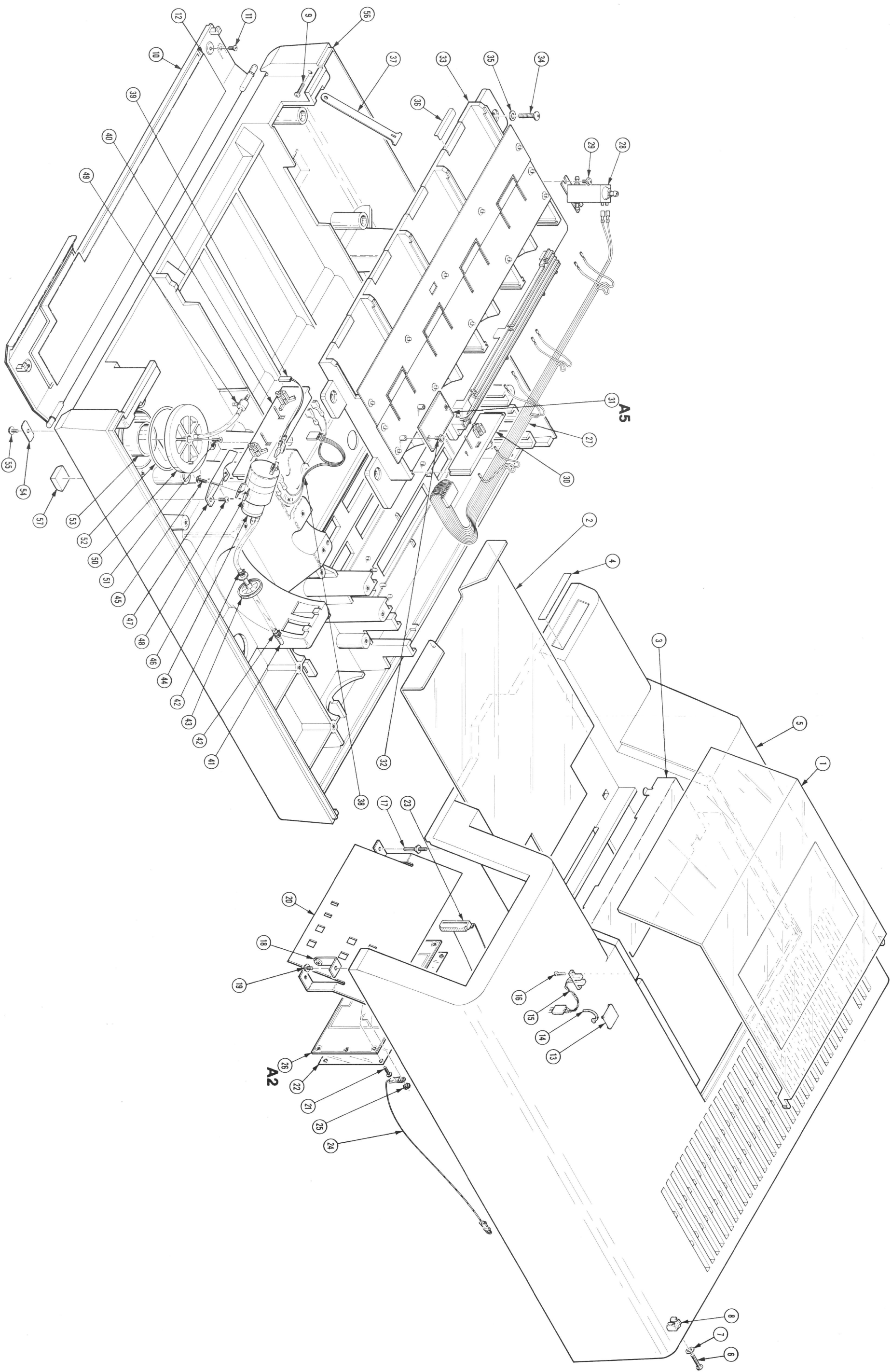
REPLACEABLE MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	200-2881-00		1		DOOR,ACCESS:TOP		
-2	436-0189-00		1		TRAY,PAPER:		
-3	351-0737-00		1		GUIDE,PAPER:STAINLESS STEEL		
-4	334-5240-00		1		MARKER,IDENT:MKD TEKTRONIX 4692		
-5	390-0906-00		1		CABINET TOP: ***** (ATTACHING PARTS) *****		
-6	212-0510-00		5		SCREW,MACHINE:10-32 X 0.750 INCH,PNH,STL	07111	ORD BY DESCR
-7	210-0805-00		5		WASHER,FLAT:0.204 ID X 0.438 INCH OD	12327	ORD BY DESCR
-8	220-0015-00		3		NUT,RETAINING:10-32,UNF		
-9	211-0509-00		2		SCREW,MACHINE: ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-10	333-3061-00		1		PANEL,FRONT:ACCESS ***** (ATTACHING PARTS) *****		
-11	211-0658-00		2		SCR,ASSEM WSHR:6-32 X 0.312 L,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-12	334-5834-00		1		GUIDE-OPERATORS:		
-13	352-0482-00		1		HOLDER,CA,TIE:0.75 SQ,STICKY BACK,PLASTIC	06383	ABMM-A
-14	343-0549-00		1		STRAP,TIEDOWN:0.091 W X 4.0 L,ZYTEL	06383	PLT1M
-15	-----		1		MICROCIRCUIT,LI:(SEE U1017 REPL) ***** (ATTACHING PARTS) *****		
-16	213-0912-00		2		SCREW,TPG,TF:4-20 X 0.25,PNH,STL,CD,PL ***** (END ATTACHING PARTS) *****	72228	ORD BY DESCR
-17	134-0014-00		2		PLUG,TIP:MALE	74970	023-0026-001
-18	407-3303-00		2		BRACKET,ANGLE:TOP CABINET,STEEL ***** (ATTACHING PARTS) *****		
-19	211-0658-00		2		SCR,ASSEM WSHR:6-32 X 0.312 L,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-20	333-3068-00		1		PANEL,FRONT: ***** (ATTACHING PARTS) *****		
-21	211-0315-00		4		SCR,ASSEM WSHR:4-40 X 0.437 PNH,STL CD PL ***** (END ATTACHING PARTS) *****	000FF	ORD BY DESCR
-22	342-0692-00		1		INSULATOR,PLATE:CIRCUIT BOARD POLYESTER		
-23	175-2265-00		1		CA ASSY,SP,ELEC:26,28 AWG,32.0 L	80009	175-2265-00
-24	196-2863-00		1		LEAD,ELECTRICAL:18 AWG,10.0 L ***** (ATTACHING PARTS) *****		
-25	210-0457-00		2		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-26	-----		1		CKT BOARD ASSY:FRONT PANEL(SEE A2 REPL)		
-27	175-9342-00		1		CA ASSY,SP,ELEC:10,22 AWG,25.75 L		
-28	-----		1		VALVE,AIR:(SEE L1001 REPL) ***** (ATTACHING PARTS) *****		
-29	211-0658-00		2		SCR,ASSEM WSHR:6-32 X 0.312 L,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-30	386-5090-01		1		PLATE,INTCON:	80009	386-5090-01
-31	-----		1		CKT BOARD ASSY:INTCON(SEE A5 REPL) ***** (ATTACHING PARTS) *****		
-32	211-0658-00		1		SCR,ASSEM WSHR:6-32 X 0.312 L,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-33	441-0130-01		1		CHAS,INK CRTG: ***** (ATTACHING PARTS) *****	80009	441-0130-01
-34	212-0509-00		4		SCREW MACHINE:10-31 X 0.625,PNH,STL,CD		
-35	210-0805-00		4		WASHER,FLAT:0.204 ID X 0.438 INCH OD ***** (END ATTACHING PARTS) *****	12327	ORD BY DESCR
-36	-----		-		CHAS,INK CRTG ASSY INCLUDES:		
	334-5707-00		1		.MARKER,IDENT:MKD BLACK		
	334-5708-00		1		.MARKER,IDENT:MKD MAGENTA		
	334-5709-00		1		.MARKER,IDENT:MKD CYAN		
	334-5710-00		1		.MARKER,IDENT:MKD YELLOW		

REPLACEABLE MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-37	346-0200-00		1		STRAP,RETAINING:PANEL		
-38	175-9344-00		1		CA ASSY,SP,ELEC:4,22 AWG,8.0 L		
-39	175-9349-00		1		CA ASSY,SP,ELEC:2,22 AWG,6.5 L		
-40	386-5121-01		1		PLATE,INTCON:		
-41	214-3620-00		1		RSTR,FLUID FLOW:DELRI	80009	214-3620-00
-42	343-1204-00		4		CLAMP,HOSE:SPRING STEEL		
-43	378-0257-00		1		FILTER ASSEMBLY:DISPOSABLE		
-44	-----		1		PUMP:(SEE B1004 REPL) ***** (ATTACHING PARTS) *****		
-45	211-0729-00		2		SCR,ASSEM WSHR:6-32 X 0.437,PAN HD		
-46	220-0789-00		2		NUT,SHEET SPR:6-32 X 0.44 L X 0.35"W,SST ***** (END ATTACHING PARTS) *****	78553	C18050SS-632
-47	407-3280-00		1		BRKT,PUMP MTG: ***** (ATTACHING PARTS) *****		
-48	211-0729-00		2		SCR,ASSEM WSHR:6-32 X 0.437,PAN HD ***** (END ATTACHING PARTS) *****		
-49	214-3686-00		2		CONN,ELAS TBG,B:AIR SUPPLY		
-50	200-2885-00		1		COV,ACCUMULATOR: ***** (ATTACHING PARTS) *****		
-51	211-0512-00		1		SCREW,MACHINE:6-32 X 0.50" 100 DEG,FLH ST ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-52	354-0464-00		1		O-RING:2.484 ID X 0.139 OD XSECT		
-53	378-0233-00		1		TUBE,PLASTLIC:1.565 OD X 1.315 ID X 2.05		
-54	210-1411-00		2		WASHER,FLAT:0.156 ID X 0.025 THK,SST ***** (ATTACHING PARTS) *****		
-55	211-0658-00		2		SCR,ASSEM WSHR:6-32 X 0.312 L,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-56	390-0907-00		1		CABINET BOTTOM:		
-57	348-0502-00		2		.FOOT,CABINET:GRAY RUBBER	04963	SJ-5023GRAY

FIG. 1 CABINET



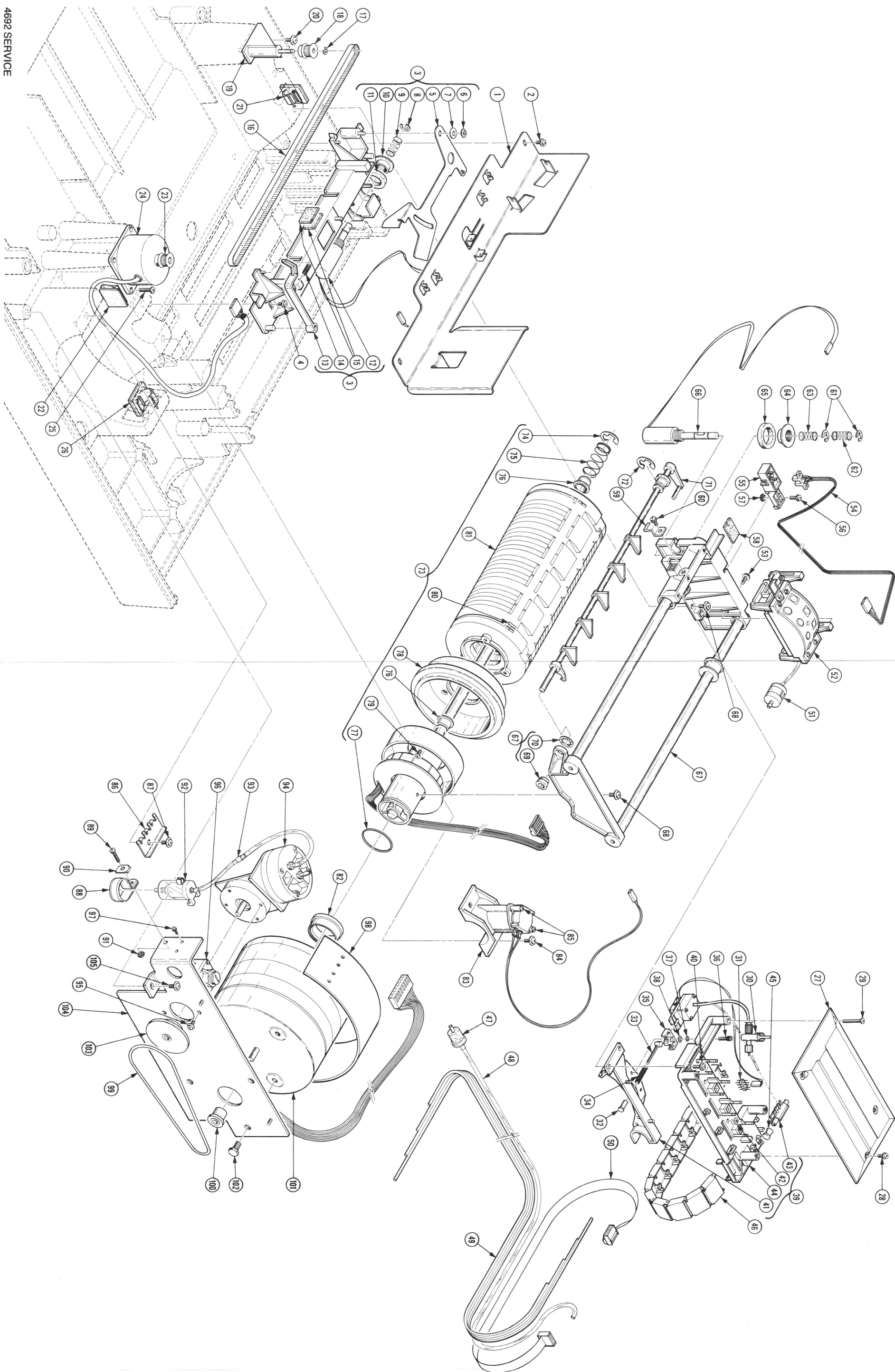


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-1	407-3194-00		1		BRACKET,ANGLE:SERVICE LOOP,ALUMINUM ***** (ATTACHING PARTS) *****		
-2	211-0658-00		2		SCR,ASSEM WSHR:6-32 X 0.312 L,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-3	655-3850-00		1		MODULAR KIT:FLUFFER ASSEMBLY ***** (ATTACHING PARTS) *****	80009	655-3850-00
-4	211-0658-00		2		SCR,ASSEM WSHR:6-32 X 0.312 L,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-5	386-5092-00		1		FLUFFER ASSY INCLUDES: .PLATE,VALVE:ALUMINUM ***** (ATTACHING PARTS) *****	80009	386-5092-00
-6	220-0004-00		2		.PUSH ON NUT:0.155 ID X 0.38 OD X 0.017		
-7	210-1392-00		2		.WASHER,FLAT:0.165 ID X 0.06 THK ***** (END ATTACHING PARTS) *****		
-8	354-0394-00		1		.RING,RETAINING: EXT TYPE E,U/O 0.312 DIA		
-9	214-3502-00		1		.SPR,VALVE CPRSN:0.75 L,CLOSED ENDS		
-10	220-0011-00		1		.NUT,PL,BARREL:0.562-18 X 0.66 DIA		
-11	214-3601-00		1		.DAMPER,SOLENOID:SILICONE		
-12			1		.SOLENOID,ELEC:(SEE L1002 REPL)		
-13	105-0610-00		2		.LATCH,TRAY:POLYCARBONATE		
-14	214-3571-00		2		.SPRING,HLEXT:0.188 OD X 0.875 L,LOOP		
-15	348-0834-00		2		PAD CUSHIONING:1.0000 X 0.650 X 0.062 THK		
-16	214-3577-00		1		BELT,POS DRIVE:0.08 PITCH,32.0 L X 0.25W		
-17	354-0175-00		1		RING,RETAINING:TYPE EXT,U/O 0.188 ID SFT	79136	5133-18-MI
-18	401-0272-00		1		WHEEL,SPROCKET:20 TEETH,0.489 OD X 0.187		
-19	386-5093-00		1		SPRT,PULLEY SFT:1.765 X 0.75 X 2.457 ***** (ATTACHING PARTS) *****		
-20	212-0500-00		1		SCR,ASSEM WSHR:10-32 X 0.375,PAN HD ***** (END ATTACHING PARTS) *****		
-21	343-0853-00		1		CLAMP,LOOP:0.5 DIA,NYLON	000GY	021-0500
-22	343-0775-00		1		CLIP,SPR TNSN:	52152	3484-1000
-23	401-0254-00		1		WHEEL,SPROCKET:20 TEETH,0.489 OD X 0.25		
-24			1		MOTOR,DC:(SEE B1001 REPL) ***** (ATTACHING PARTS) *****		
-25	212-0509-00		2		SCREW MACHINE:10-31 X 0.625,PNH,STL,CD ***** (END ATTACHING PARTS) *****		
-26	343-0835-00		1		CLAMP,LOOP:0.375 ID,NYLON W/ADH	34785	021-0375
-27	200-2893-00		1		COVER,CARRIAGE:PREVEX ***** (ATTACHING PARTS) *****	80009	200-2893-00
-28	211-0658-00		3		SCR ASSEM WSHR:6-32 X 0.312,PNH,STL POZ	T0435	ORD BY DESCR
-29	211-0628-00		1		SCREW,MACHINE:6-32 X 1.125 INCH,PNH,STL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-30	655-3845-00		1		MODULAR KIT:INK JET HEAD ASSY	80009	655-3845-00
-31	131-3233-00		1		TERM SET,PIN:8 CONTACT,MALE		
-32	220-0954-00		6		.NUT,ADJUSTING:2-56 X 0.25 HEX,0.545 ***** (ATTACHING PARTS) *****		
-33	211-0128-01		6		.SCREW,MACHINE:2-56 X 1.25,SPECIAL HEAD ***** (END ATTACHING PARTS) *****		
-34	214-3606-00		6		.SPRING,HLCPS:0.180 OD X 0.026 X 0.810		
-35	391-0180-00		4		.BLOCK,ADJUSTING: ***** (ATTACHING PARTS) *****		
-36	211-0627-00		4		.SCREW,CAP:6-32 X 0.500,SCH,STL,CD PL		
-37	210-1199-00		4		.WASHER,SPR TNSN:0.148 ID X 0.0045 THK		
-38	210-0870-00		4		.WASHER,FLAT:0.14 ID X 0.312 INCH OD STL ***** (END ATTACHING PARTS) *****	12327	ORD BY DESCR
-39	655-4278-00		1		MODULAR KIT:CARRIAGE SUBASSY ***** (ATTACHING PARTS) *****	80009	655-4278-00
-40	211-0648-00		2		SCR ASSEM WSHR:6-32 X 0.625 INCH,PNH,STL ***** (END ATTACHING PARTS) *****	80009	211-0648-00

REPLACEABLE MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-	-----			-		CARRIAGE ASSY INCLUDES:		
-41	214-3504-00			1		.CARRIAGE:	80009	214-3504-00
-42	220-0010-00			2		.PUSH ON NUT:0.141 STUD,0.12 THK		
-43	214-3613-00			1		.MANIFOLD,AIR:CARRIAGE,0.412 X 0.536		
-44	407-3204-00			1		.BRACKET,MTG:VALVE	80009	407-3204-00
-45	200-3039-00			1		COVER:0.187 ID X 0.375 L,BLACK VINYL		
-46	214-3568-00			1		LK,SVCE LOOP AS:		
-47	378-0251-00			1		FILTER,AIR:INLINE,MINIATURE		
-48	255-0904-01			AR		TUBING,NM:0.187 ID X 0.31 THK 25.5 L	80009	255-0904-01
-49	255-0906-01			AR		TUBING,NM:0.062 ID X 0.31 THK 52.0 L	80009	255-0906-01
-50	175-9222-00			1		CA ASSY,SP,ELEC:FLEX,10 CNDCT,27.0 L		
-51	214-3720-00			1		VALVE,CHECK:W/OUTLET FLOW RESTRICTOR		
-52	119-1817-00			1		HD MAINT STA AS:		
						***** (ATTACHING PARTS) *****		
-53	211-0729-00			2		SCR,ASSEM WSHR:6-32 X 0.437,PAN HD		
						***** (END ATTACHING PARTS) *****		
-54	-----			1		MICROCIRCUIT,LI:(SEE U1015 REPL)		
-55	407-3227-00			1		BRACKET,SWITCH:	80009	407-3227-00
						***** (ATTACHING PARTS) *****		
-56	211-0729-00			1		SCR,ASSEM WSHR:6-32 X 0.437,PAN HD		
-57	210-0457-00			1		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	ORD BY DESCR
						***** (END ATTACHING PARTS) *****		
-58	348-0834-00			1		PAD,CUSHIONING:1.000 X 0.650 X 0.062 THK		
-59	343-1167-00			1		CLP,POS DR BELT:0.380 X 0.470 X 0.820		
						***** (ATTACHING PARTS) *****		
-60	211-0658-00			1		SCR,ASSEM WSHR:6-32 X 0.312 L,PNH,STL	78189	ORD BY DESCR
						***** (END ATTACHING PARTS) *****		
-61	354-0394-00			2		RING,RETAINING: EXT TYPE E,U/O 0.312 DIA		
-62	214-3501-00			1		SPRING,HLCPS:1.476L,CLOSED ENDS,MUSIC WIRE		
-63	214-3502-00			1		SPR,VALVE CPRSN:0.75 L,CLOSED ENDS,MUSIC W		
-64	220-0011-00			1		NUT,PL,BARREL:0.562-18 X 0.66 DIA,AL		
-65	214-3601-00			1		DAMPER,SOLENOID:SILICONE		
-66	-----			1		SOLENOID,ELEC:(SEE L1003 REPL)		
-67	655-3843-00			1		MODULAR KIT:FRAME	80009	655-3843-00
						***** (ATTACHING PARTS) *****		
-68	212-0500-00			3		SCR,ASSEM WSHR:10-32 X 0.375,PAN HD		
						***** (END ATTACHING PARTS) *****		
	-----			-		FRAME ASSY INCLUDES:		
-69	358-0695-00			1		.BSHG,STRIPPER:0.438 DIA,DELRLN		
						***** (ATTACHING PARTS) *****		
-70	220-0005-00			1		.PUSH ON NUT:0.437 ID X 0.73 OD X 0.014		
						***** (END ATTACHING PARTS) *****		
-71	384-1253-00			1		SHAFT,STRIPPER:STAINLESS STEEL		
-72	354-0616-00			1		RING,RETAINING:EXTERNAL,FOR 0.5 OD		
-73	655-3852-00			1		MODULAR KIT:DRUM ASSEMBLY		
	-----			-		DRUM ASSY INCLUDES:		
-74	354-0616-00			1		.RING,RETAINING:EXTERNAL,FOR 0.5 OD		
-75	214-3518-00			1		.SPRING,HLCPS:0.646 ID X 1.45 L		
-76	361-1262-00			2		.SPACER,DRUM:ALUMINUM		
-77	354-0466-00			1		.O-RING:1.364 ID X 0.7 OD X SECT		
-78	214-3572-00			1		.FLYWHEEL,COPIER:		
						***** (ATTACHING PARTS) *****		
-79	211-0559-00			3		.SCREW,MACHINE:6-32 X 0.375,FLH,100 DEG,ST		
						***** (END ATTACHING PARTS) *****		
-80	200-3103-01			AR		.COVER,HOLE:DRUM		
-81	105-0532-00			1		.DRUM,COPIER:		
-82	348-0786-00			1		GASKET:BLOWER,INLET		

REPLACEABLE MECHANICAL PARTS

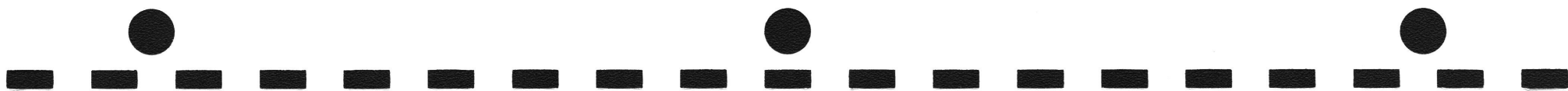
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-83	655-4277-00		1		MODULAR KIT:DRUM BLOWER CLAMP/PRESSURE ***** (ATTACHING PARTS) *****	80009	655-4277-00
-84	212-0500-00		2		SCR,ASSEM WSHR:10-32 X 0.375,PAN HD ***** (END ATTACHING PARTS) *****		
-85	211-0017-00		2		PRESSURE SW ASSY INCLUDES: .SCREW,MACHINE:4-40 X 0.375 INCH,PNH STL	83385	ORD BY DESCR
-86	343-1156-00		1		CLAMP,BLOWER:0.063 ALUMINUM ***** (ATTACHING PARTS) *****		
-87	212-0500-00		1		SCR,ASSEM WSHR:10-32 X 0.375,PAN HD ***** (END ATTACHING PARTS) *****		
-88	343-0006-00		1		CLAMP,LOOP:0.50 INCH DIAMETER,PLSTC ***** (ATTACHING PARTS) *****	95987	1-2-6B
-89	211-0511-00		1		SCREW,MACHINE:6-32 X 0.500,PNH,STL,CD PL	83385	ORD BY DESCR
-90	210-0863-00		1		WSHR,LOOP CLAMP:0.187 ID U/W 0.5 W CLP,STL	95987	C191
-91	210-0457-00		1		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-92	214-3721-00		1		SEPARATOR,WATER:		
-93	214-3621-00		1		RSTR,FLUID FLOW:DEL RIN	80009	214-3621-00
-94	214-2242-00		1		PUMP,AIR: ***** (ATTACHING PARTS) *****		
-95	211-0564-00		2		SCR,CAP:6-32 X 0.375,SCH,STL,BK	80009	211-0564-00
	210-0802-00		2		WASHER,FLAT:0.15 ID X 0.032 THK,STL CD ***** (END ATTACHING PARTS) *****		
-96	214-2214-00		1		REGULATOR,AIR: ***** (ATTACHING PARTS) *****		
-97	211-0244-00		2		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-98	346-0197-00		1		BAND,RETAINING:BLOWER,18.850 X 2.500		
-99	214-2233-00		1		BELT,DRIVE:AIR PUMP		
-100	401-0250-00		1		PULLEY,GROOVE:SMALL		
-101	-----		1		FAN,CENTRIFUGAL:(SEE B1003 REPL) ***** (ATTACHING PARTS) *****		
-102	213-0001-00		3		SCREW,CAP,SCH:0.25-20 X 0.50 INCH LONG ST ***** (END ATTACHING PARTS) *****	000AH	ORD BY DESCR
-103	401-0251-00		1		PULLEY,GROOVE:LARGE		
-104	407-3131-00		1		BRACKET,BLOWER:AIR PUMP ***** (ATTACHING PARTS) *****		
-105	212-0500-00		1		SCR,ASSEM WSHR:10-32 X 0.375,PAN HD ***** (END ATTACHING PARTS) *****		

REPLACEABLE MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
3-1	175-9345-00		1		CA ASSY,SP,ELEC:7,26 AWG,29.5 L		
-2	175-9348-00		1		CA ASSY,SP,ELEC:4,26 AWG,28.0 L		
-3	175-9343-00		1		CA ASSY,SP,ELEC:4,22 AWG,31.5 L		
-4	346-0120-00		1		STRAP,TIEDOWN:5.5 L MIN,PLASTIC	06383	SST 1.5M
-5	407-3125-00		1		BRKT,HEAT SINK:ALUMINUM ***** (ATTACHING PARTS) *****		
-6	212-0500-00		4		SCR,ASSEM WSHR:10-32 X 0.375,PAN HD ***** (END ATTACHING PARTS) *****		
-7	361-1258-00		2		SPACER,CKT BD:0.125 X 0.375 X 6.75		
-8	-----		1		CKT BOARD ASSY:DRIVE MODULE(SEE A4 REPL)		
-9	344-0286-00		8		.CLIP,ELECTRICAL:FOR 3AG FUSE,BRS	75915	102074
-10	-----		10		.TRANSISTOR:(SEE A4Q151,Q155,Q161,Q165, A4Q171,Q175,Q181,Q185,Q191,Q195 REPL) ***** (ATTACHING PARTS) *****		
-11	211-0315-00		10		.SCR,ASSEM WSHR:4-40 X 0.437 PNH,STL CD PL	000FF	ORD BY DESCR
-12	342-0536-00		10		.INSULATOR,XSTR:TO-220,POLYENELENE ***** (END ATTACHING PARTS) *****	80009	342-0536-00
-13	342-0672-00		1		.INSULATOR,PLATE:TRANSISTOR,SI RUBBER		
-14	-----		9		.TRANSISTOR:(SEE A4Q473,Q475,Q483,Q485, A4Q487,Q495,Q581,Q585,Q591 REPL) ***** (ATTACHING PARTS) *****		
-15	211-0661-00		9		.SCREW,MACHINE:4-40 X 0.25 INCH,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-16	342-0665-00		1		.INSULATOR,PLATE:TRANSISTOR,SI RUBBER		
-17	214-3513-00		1		.HEAT SINK,XSTR:ALUMINUM ***** (ATTACHING PARTS) *****		
-18	211-0246-00		1		.SCR,ASSEM WSHR:4-40 X 0.625 INCH,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR
-19	-----		4		.MICROCIRCUIT,LI:(SEE A4U871,U881,U886, A4U891 REPL) ***** (ATTACHING PARTS) *****		
-20	211-0315-00		4		.SCR,ASSEM WSHR:4-40 X 0.437 PNH,STL CD PL	000FF	ORD BY DESCR
-21	342-0536-00		4		.INSULATOR,XSTR:TO-220,POLYENELENE ***** (END ATTACHING PARTS) *****	80009	342-0536-00
-22	342-0671-00		1		.INSULATOR,PLATE:TRANSISTOR,SI RUBBER		
-23	334-6015-00		1		.MARKER,IDENT:MKD CABLE DESIGNATION		
-24	214-3490-00		1		.HT SINK,CKT BD: ***** (ATTACHING PARTS) *****	80009	214-3490-00
-25	211-0661-00		5		.SCREW,MACHINE:4-40 X 0.25 INCH,PNH,STL	78189	ORD BY DESCR
-26	175-9334-00		2		.CA ASSY,SP,ELEC:FLEX,24 CNDCT,2.25 L		
-27	-----		1		CKT BOARD ASSY:PROCESS CONTROL(SEE A3 REPL) ***** (ATTACHING PARTS) *****		
-28	211-0513-00		4		SCREW,MACHINE:6-32 X 0.625 INCH,PNH STL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-29	386-1559-00		2		CIRCUIT BOARD ASSY INCLUDES: .SPACER,CKT BD:0.47 H,ACETAL	80009	386-1559-00
-30	136-0755-00		1		.SKT,PL-IN ELEK:MICROCIRCUIT,28 DIP	09922	DILB28P-108
-31	136-0751-00		2		.SKT,PL-IN ELEK:MICROCKT,24 PIN	09922	DILB24P108
-32	136-0757-00		1		.SKT,PL-IN ELEK:MICROCKT,40 PIN	09922	DILB40P-108
-33	136-0832-00		2		.SKT,PL-IN ELEK:MICROCIRCUIT,25 CONTACTS		
-34	344-0363-00		1		CLIP,CONNECTOR:		
-35	131-3101-00		1		CONN,RCPT,ELEC:CKT BD,25 CONTACT,0.1		
-36	-----		1		CKT BOARD ASSY:PARALLEL INTERF(SEE A1 REPL) ***** (ATTACHING PARTS) *****		
-37	211-0658-00		2		SCR,ASSEM WSHR:6-32 X 0.312 L,PNH,STL ***** (END ATTACHING PARTS) *****	78189	ORD BY DESCR

REPLACEABLE MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
3-38	131-0993-00		4		.BUS,CONDUCTOR:2 WIRE BLACK	00779	850100-01
	-----		-		.(STANDARD ONLY)		
	131-0993-00		16		.BUS,CONDUCTOR:2 WIRE BLACK	00779	850100-01
	-----		-		.(OPTION 02 ONLY)		
-39	131-0608-00		2		.TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
-40	136-0252-01		2		.CONTACT,ELEC:0.178 INCH LONG	00779	1-332095-2
	-----		-		.(STANDARD ONLY)		
	136-0252-01		8		.CONTACT,ELEC:0.178 INCH LONG	00779	1-332095-2
	-----		-		.(OPTION 02 ONLY)		
-41	136-0751-00		1		.SKT,PL-IN ELEK:MICROCKT,24 PIN	09922	DILB24P108
-42	136-0755-00		1		.SKT,PL-IN ELEK:MICROCIRCUIT,28 DIP	09922	DILB28P-108
-43	136-0752-00		1		.SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P-108
-44	136-0757-00		1		.SKT,PL-IN ELEK:MICROCKT,40 PIN	09922	DILB40P-108
-45	386-2983-00		1		PLATE,CONN MTG:ALUMINUM		
	-----		-		(STANDARD ONLY)		
	386-5085-00		1		PLATE,CONN MTG:ALUMINUM		
	-----		-		(OPTION 02 ONLY)		
					***** (ATTACHING PARTS) *****		
-46	129-0887-02		2		SPACER,POST:0.531 L X M3.5 X 0.6 INT		
	-----		-		(STANDARD ONLY)		
	129-0887-02		8		SPACER,POST:0.531 L X M3.5 X 0.6 INT		
	-----		-		(OPTION 02 ONLY)		
-47	210-0812-00		2		WASHER,NONMETAL: #10,FIBER	86445	ORD BY DESCR
	-----		-		***** (END ATTACHING PARTS) *****		
-48			1		XFMR,PWR,STPDN:(SEE T1001 REPL)		
					***** (ATTACHING PARTS) *****		
-49	210-0457-00		1		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	ORD BY DESCR
-50	212-0515-00		4		SCREW,MACHINE:10-32 X 2.250" HEX.HD STL	83385	ORD BY DESCR
-51	210-0812-00		4		WASHER,NONMETAL: #10,FIBER	86445	ORD BY DESCR
-52	166-0457-00		4		INSUL SLVG,ELEC:0.19 ID X 1.875" LONG MYLAR	80009	166-0457-00
					***** (END ATTACHING PARTS) *****		
-53	334-6001-00		1		MARKER,IDENT:MKD CAUTION		
-54	196-2872-00		1		LEAD ELECTRICAL:18 AWG,3.2 L		
-55	196-2863-00		1		LEAD,ELECTRICAL:18 AWG,10.0 L		
					***** (ATTACHING PARTS) *****		
-56	210-0457-00		1		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	ORD BY DESCR
					***** (END ATTACHING PARTS) *****		
-57	196-2860-00		1		LEAD,ELECTRICAL:1,18 AWG,6.0 L		
					***** (ATTACHING PARTS) *****		
-58	210-0457-00		1		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	ORD BY DESCR
					***** (END ATTACHING PARTS) *****		
-59			1		FILTER,LINE:(SEE FL1001 REPL)		
-60	334-6070-00		1		MARKER,IDENT:MKD CAUTION		
-61			1		SEMICONV DEVICE:(SEE CR1001 REPL)		
					***** (ATTACHING PARTS) *****		
-62	210-0457-00		1		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	ORD BY DESCR
					***** (END ATTACHING PARTS) *****		
-63	333-3067-00		1		PANEL,REAR:		
					***** (ATTACHING PARTS) *****		
-64	212-0500-00		1		SCR,ASSEM WSHR:10-32 X 0.375,PAN HD		
					***** (END ATTACHING PARTS) *****		
-65	343-1147-00		1		STRAP,TIEDOWN,E:3.32 W X 15.18 L		
-66	175-9347-00		1		CA ASSY,SP,ELEC:4,18 AWG,10.5 L		
					***** (ATTACHING PARTS) *****		
-67	212-0500-00		2		SCR,ASSEM WSHR:10-32 X 0.375,PAN HD		
					***** (END ATTACHING PARTS) *****		
-68	196-2848-00		1		LEAD,ELECTRICAL:14 AWG,8.0 L		
-69	196-2849-00		1		LEAD,ELECTRICAL:14 AWG,8.0 L		
-70	198-5413-00		1		WIRE SET,ELEC:		
-71			1		.RES.,FXD,WW:(SEE R1001 REPL)		
-72			1		CAP,FXD,ELCTLT:(SEE C1002 REPL)		



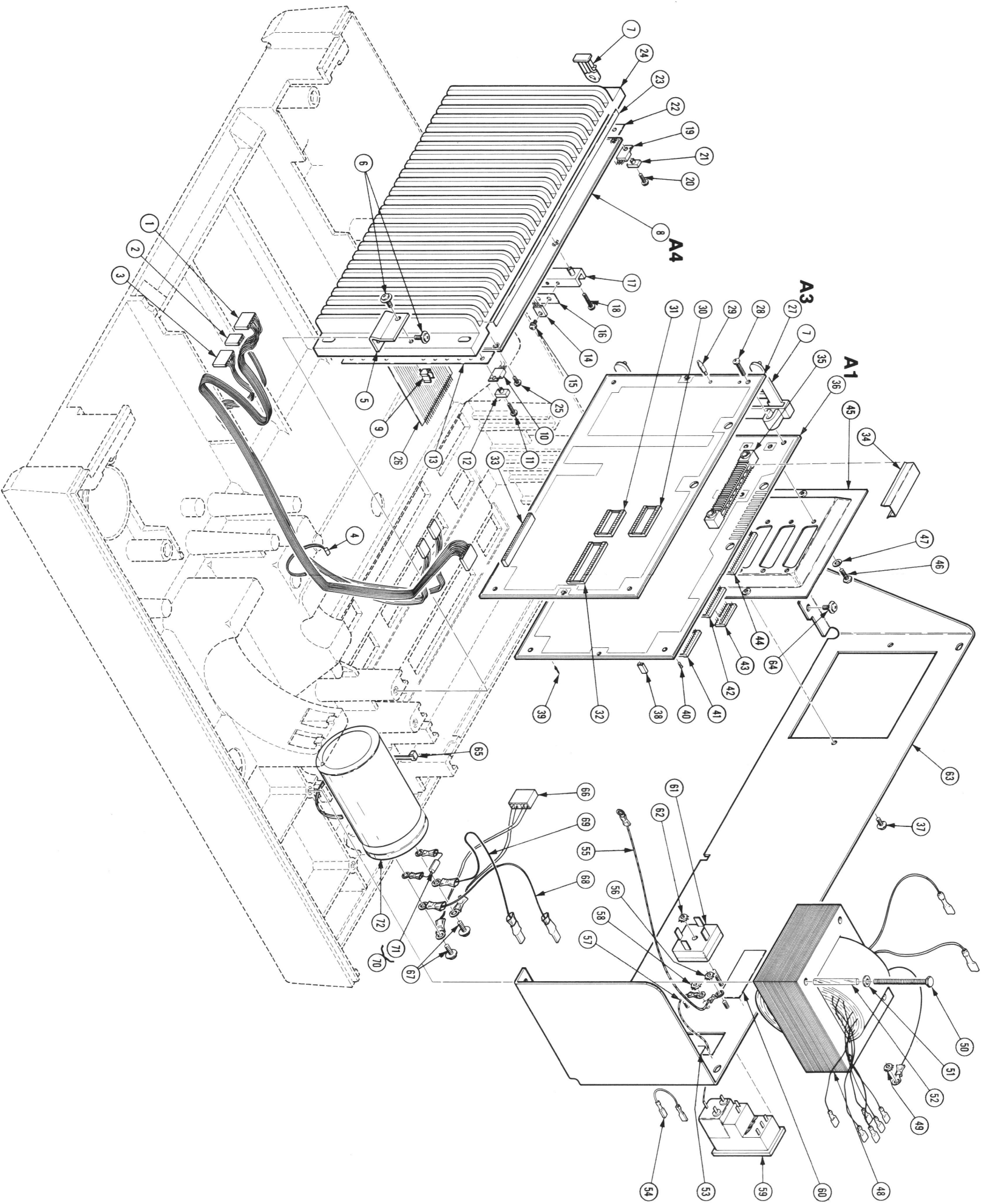
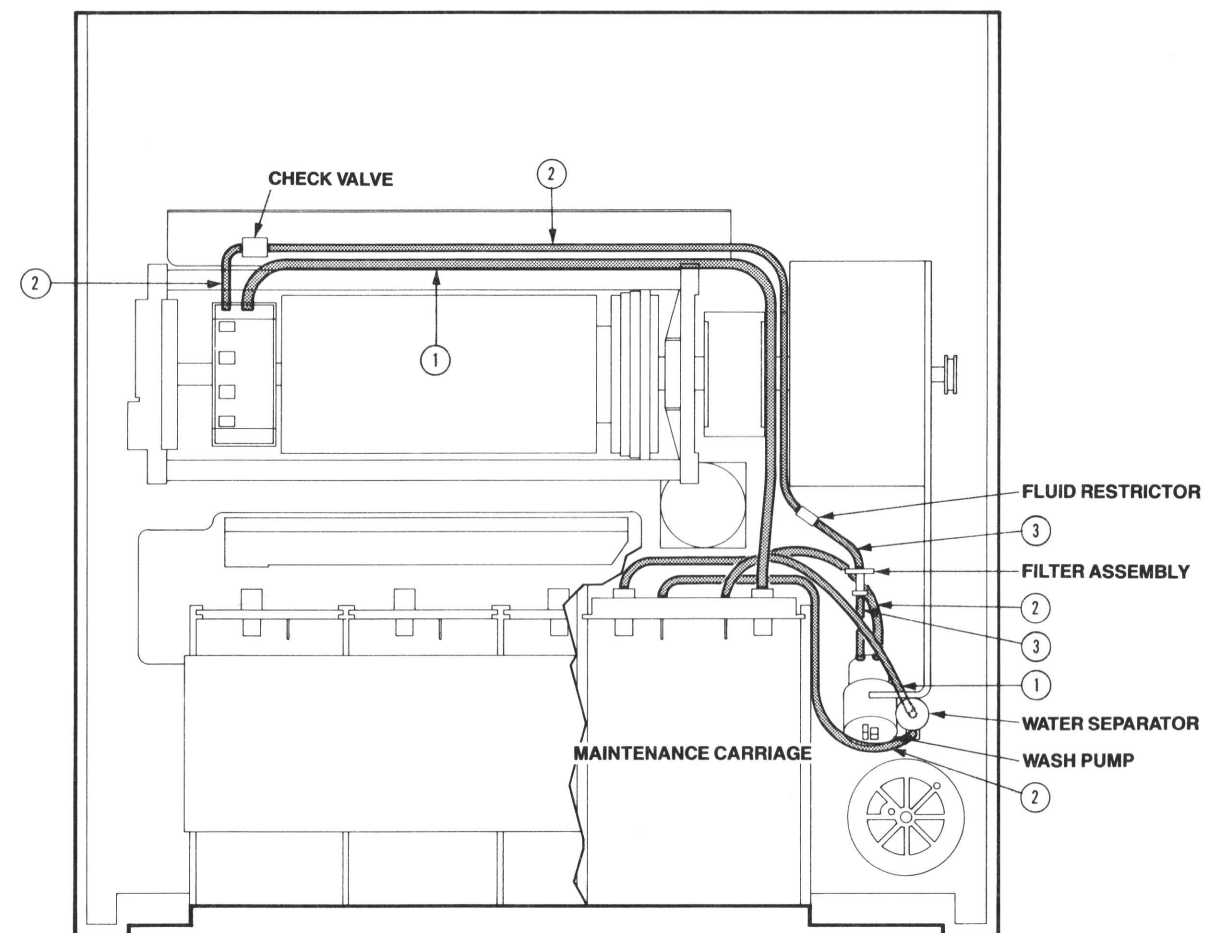
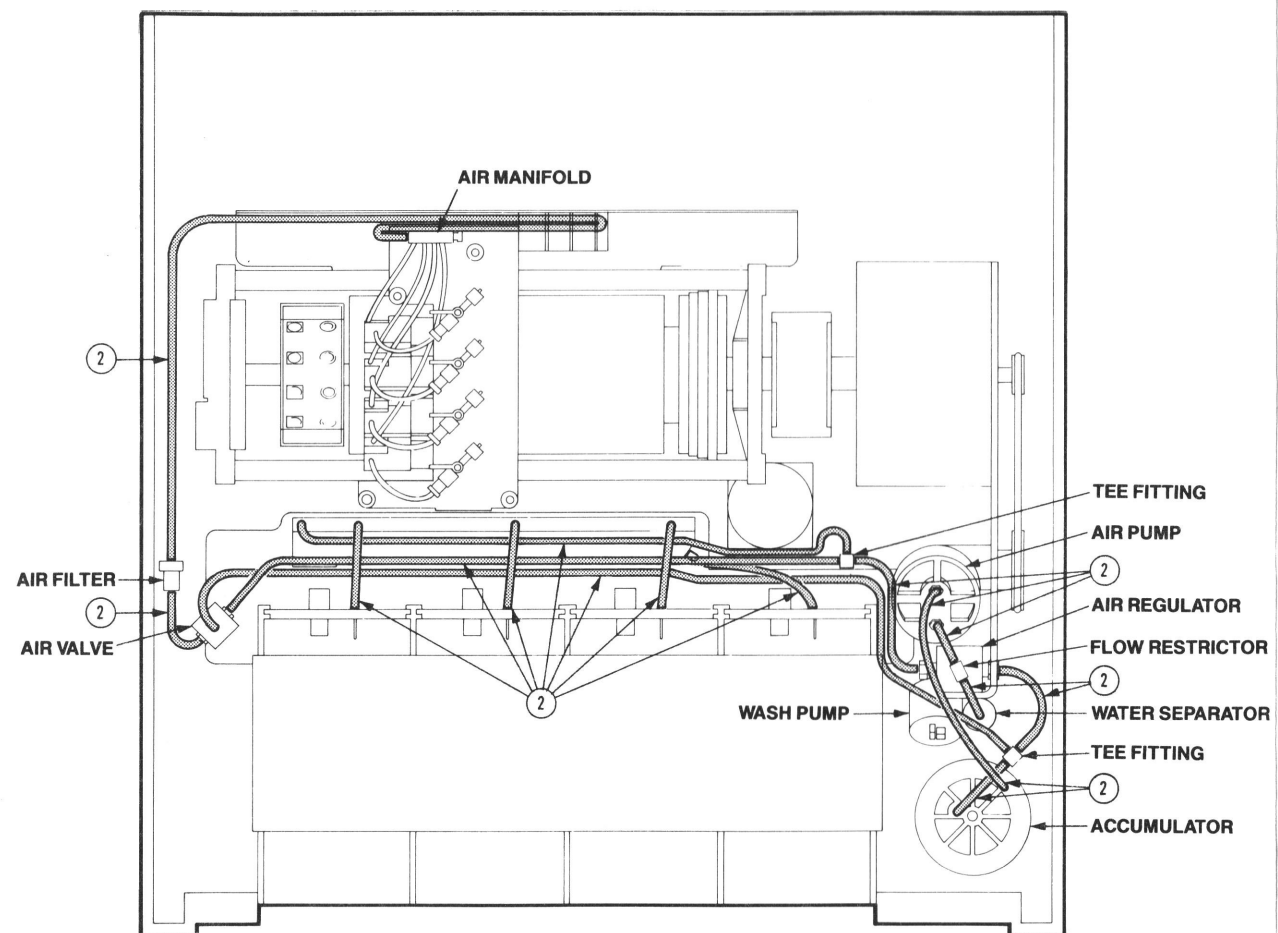


FIG. 3 REAR



REPLACEABLE MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1 2 3 4 5					Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont									
4-1	255-0904-01			AR						TUBING,PLASTIC:0.187 ID X 0.31 THK 25.5 L	80009	255-0904-01
-2	255-0905-01			AR						TUBING,PLASTIC:0.125 ID X 0.31 THK 42.0 L	80009	255-0905-01
-3	255-0943-01			AR						TUBING,PLASTIC:0.156 ID X 0.281 OD X 0.062	80009	255-0943-01

REPLACEABLE MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
STANDARD ACCESSORIES							
5-1	161-0066-00		1		CABLE ASSY,PWR,;3,18 AWG,115V,98.0 L (STANDARD ONLY)	T1372	ORD BY DESCR
-2	161-0066-09		1		CABLE ASSY,PWR:3,0.75MM SQ,220V,99.0 L (OPTION A1 ONLY)	S3109	VIIGSOP0-H05VVF3
-3	161-0066-10		1		CABLE ASSY,PWR:3,0.75MM SQ,240V,96.0 L (OPTION A2 ONLY)	S3109	ORD BY DESCR
-4	161-0066-11		1		CABLE ASSY,PWR:3,0.75MM,240V,96.0L (OPTION A3 ONLY)	S3109	SAA/3-003CCFC3X0
-5	334-3995-00		1		.MARKER,IDENT:MARKED CAUTION	80009	334-3995-00
-6	161-0066-12		1		CABLE ASSY,PWR:3,18 AWG,240V,96.0 L (OPTION A4 ONLY)	T1105	ORD BY DESCR
-7	161-0154-00		1		CABLE ASSY,PWR:3,0.75MM SQ,240V,6A,2.5M L (OPTION A5 ONLY)	000JA	A25SW
-8	436-0172-01		1		PAPER TRAY ASSY:	80009	436-0172-01
-9	200-3047-00		1		.COVER,TRAY:12.1 X 8.2,ACETATE		
-10	214-3651-00		1		.FLAP,TRAY:7.41 X 4.44 X 0.003 THK		
-11	351-0729-00		1		.GUIDE,PAPER:FIXED		
-12	214-3012-00		2		.FSTNR,SNAP-IN:0.437 L X 0.131 DIA,PNH	80009	214-3012-00
-13	351-0730-00		1		.GUIDE,PAPER:SLIDING		
-14	436-0189-00		1		TRAY,PAPER:	80009	436-0189-00
-15	016-0713-01		1		CARTRIDGE,INK:CYAN	80009	016-0713-01
	016-0714-01		1		CARTRIDGE,INK:BLACK	80009	016-0714-01
	016-0715-01		1		CARTRIDGE,INK:YELLOW	80009	016-0715-01
	016-0716-01		1		CARTRIDGE,INK:MAGENTA	80009	016-0716-01
-16	650-1722-00		1		MISC KIT:COPY COUNTER	80009	655-1722-00
	070-4816-00		1		MANUAL,TECH:OPERATORS,4692	80009	070-4816-00
OPTIONAL ACCESSORIES							
-17	012-0518-00		1		CABLE,INTCON:120.0 L		
	012-0527-00		1		CABLE,INTCON:4691 TO 4100 SERRIES(9M)		
-18	016-0770-01		1		CARTRIDGE ASSY:MAINTENANCE		
	016-0793-00		1		PAPER,PRINTER:8.5 X 11.0,A SIZE,COATED		
	016-0794-00		1		PAPER,PRINTER:210 X 297MM,A4 AIZE,COATED		
	067-1204-00		1		FIXTURE,CAL:THRESHOLD VOLTAGE PATTERN	80009	067-1204-00
	070-4815-00		1		MANUAL,TECH:SERVICE,4692	80009	070-4815-00
	070-4818-00		1		MANUAL,TECH:DEVICE DRIVER DEVELOPMENT	80009	070-4818-00
	016-0765-02		1		PLASTIC SHEET:8.5 X 11.0,A SIZE,100 SHEET		
	016-0766-02		1		PLASTIC SHEET:210MM X 297MM,A4 SIZE 100 SH		

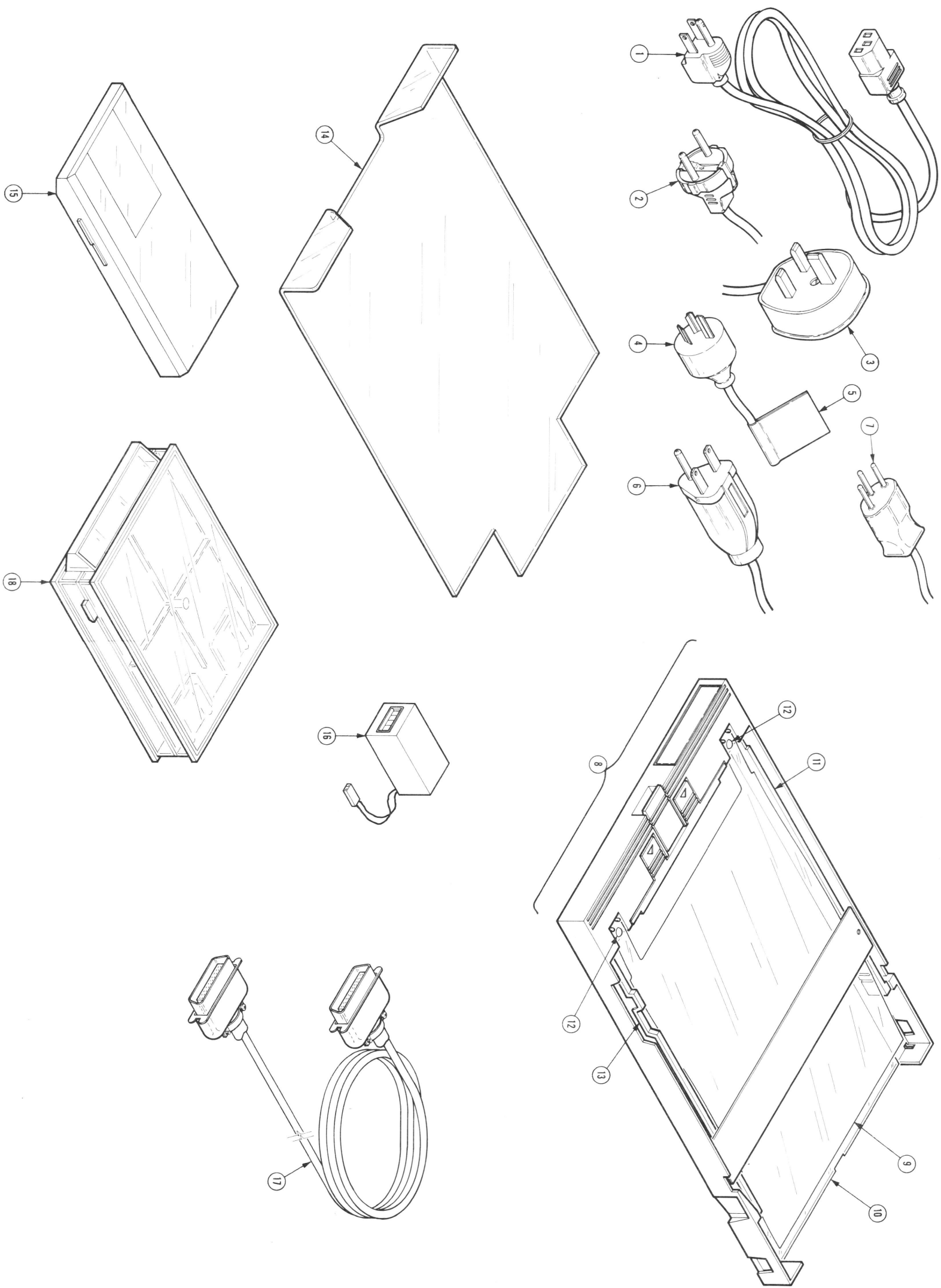


FIG. 5 ACCESSORIES

.
 A1 -----
 .
 A2 -----
 .
 A3 -----
 .
 A4 -----
 .
 A5 -----
 .
 01 -----
 .
 02 -----
 .
 03 -----
 .
 04 -----

OPTIONS

220V,EURO PLUG:

240V,UK PLUG:

240V,AUST PLUG:

240V,N AMERICAN PLUG:

220V,SWISS PLUG:

A4 SIZE OUTPUT:SET-UP FOR A4

MULTIPLEXER:FOUR CHANNEL

SUPPLY KIT(A):SUPPLIES START-UP KIT A4 SIZ

SUPPLY KIT(A4):SUPPLIES START-UP KIT A4 SI

Appendix G
FIRMWARE AND MEMORY LOCATIONS

INTRODUCTION

The structure of the color copier electronic hardware contains two separate microprocessor systems. These are the Interface processor which communicates with the host, and the "Print Engine" processor which controls the copier processes. The following information is divided into these two areas.

INTERFACE PROCESSOR MEMORY MAP

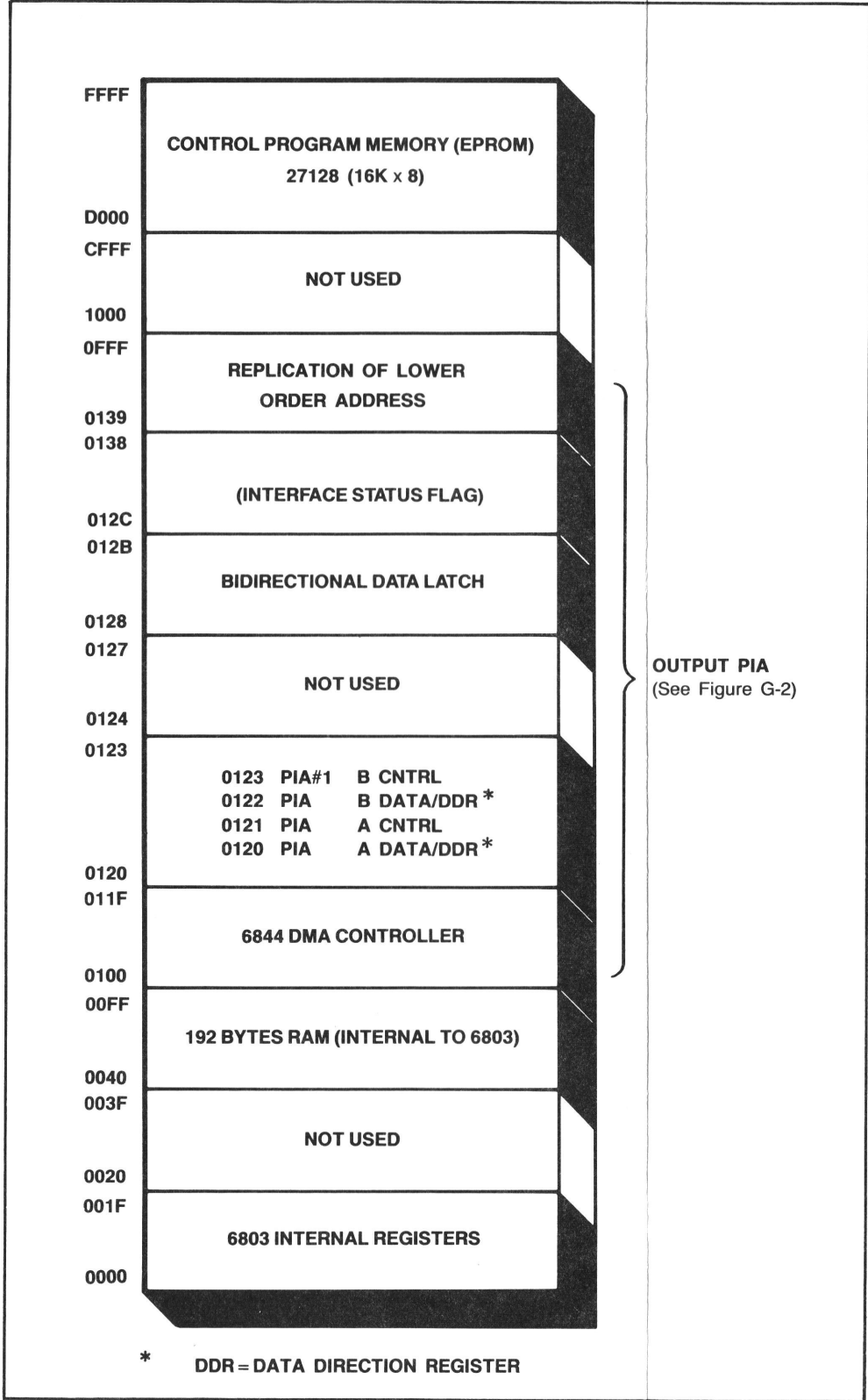


Figure G-1. Parallel Interface Processor Memory Assignments.

INTERFACE PROCESSOR MEMORY MAP (cont)

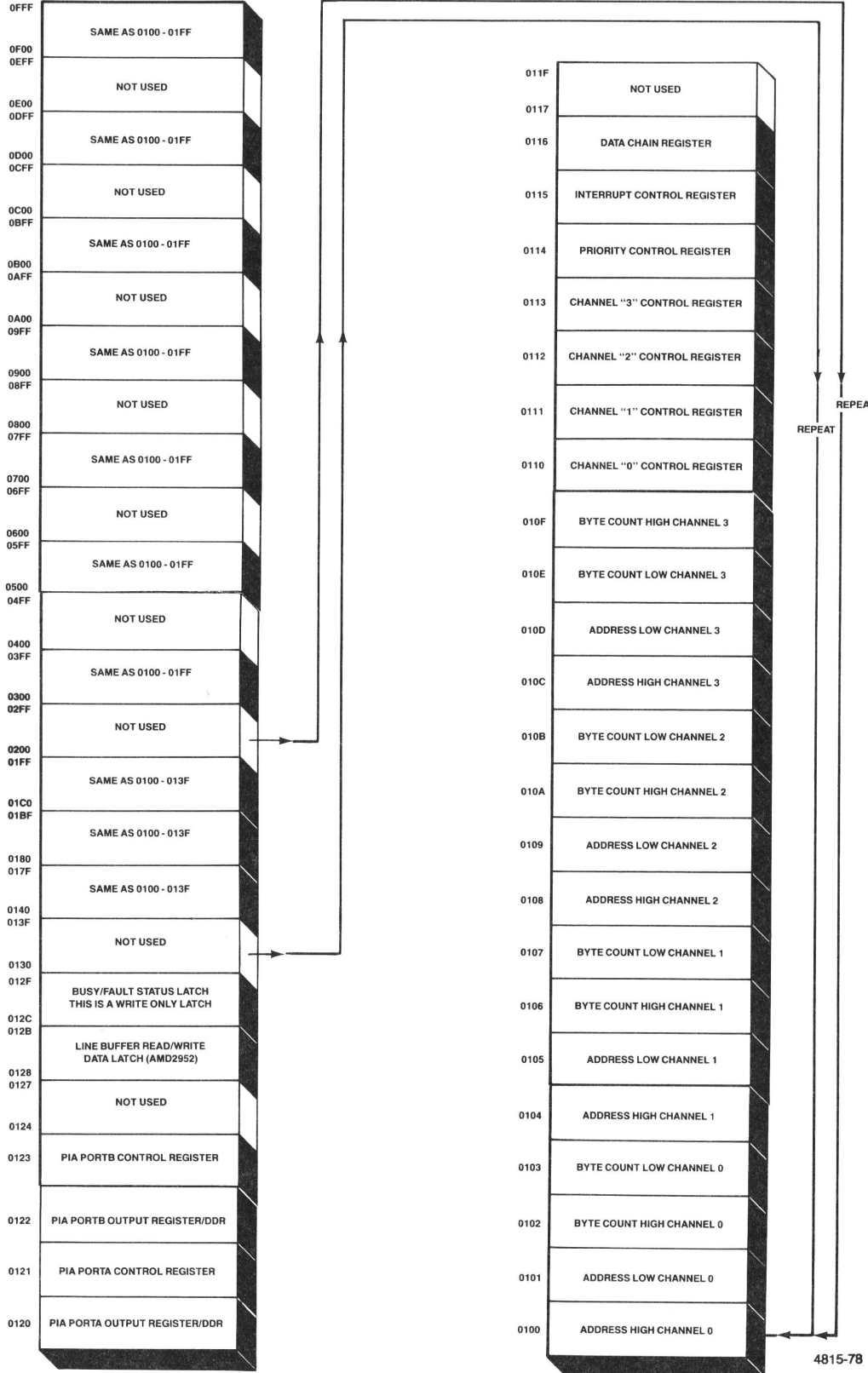
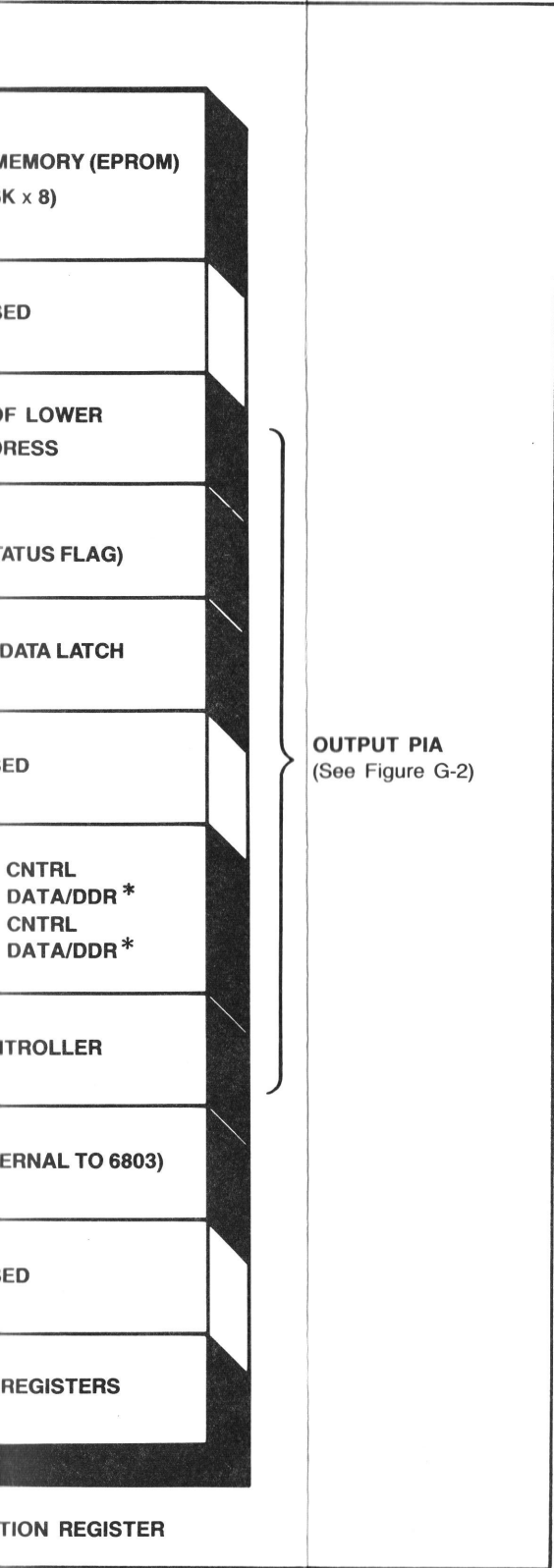


Figure G-2. Output Peripheral Interface Adapter Memory Map.

MEMORY MAP



OUTPUT PIA
(See Figure G-2)

INTERFACE PROCESSOR MEMORY MAP (cont)

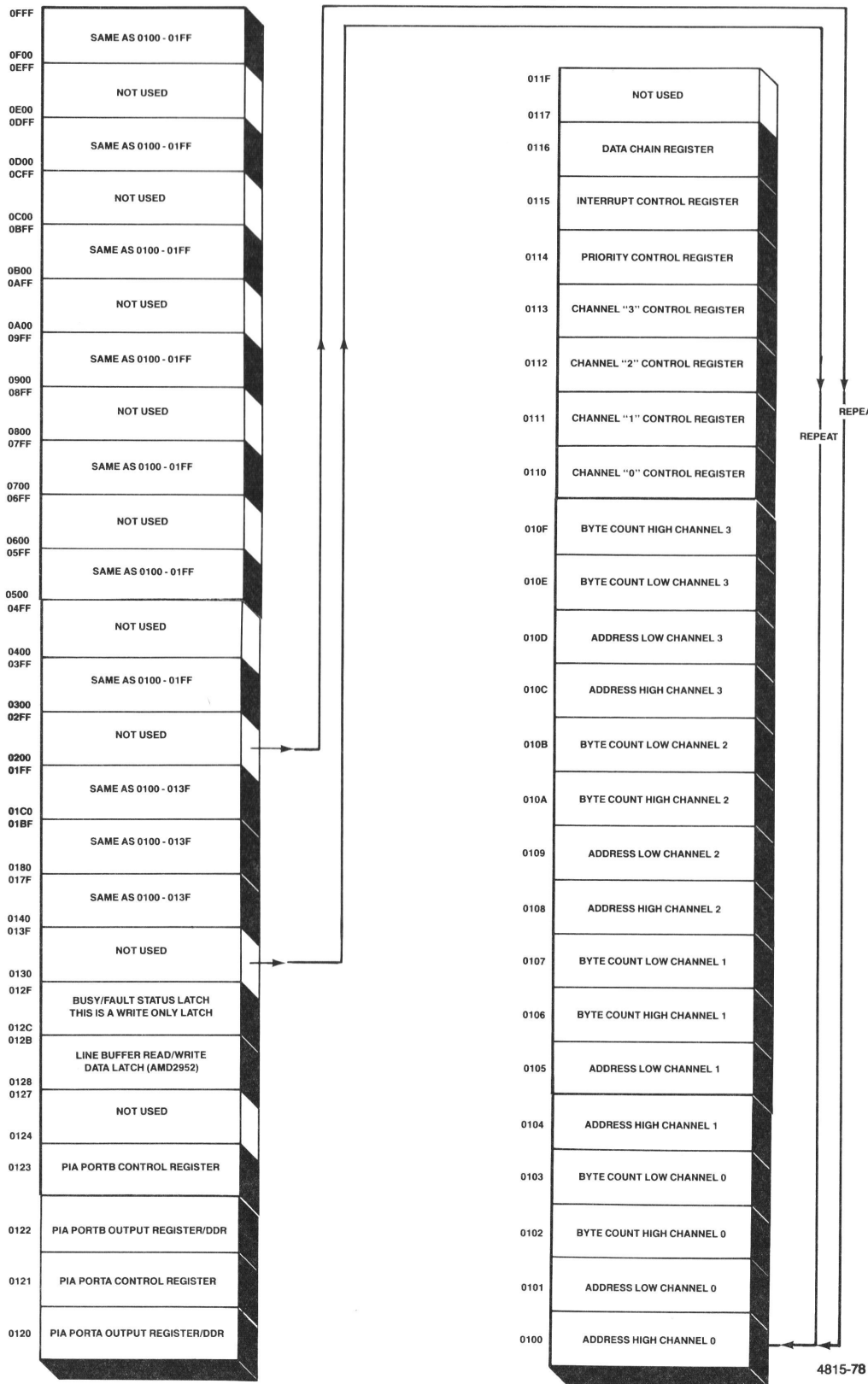
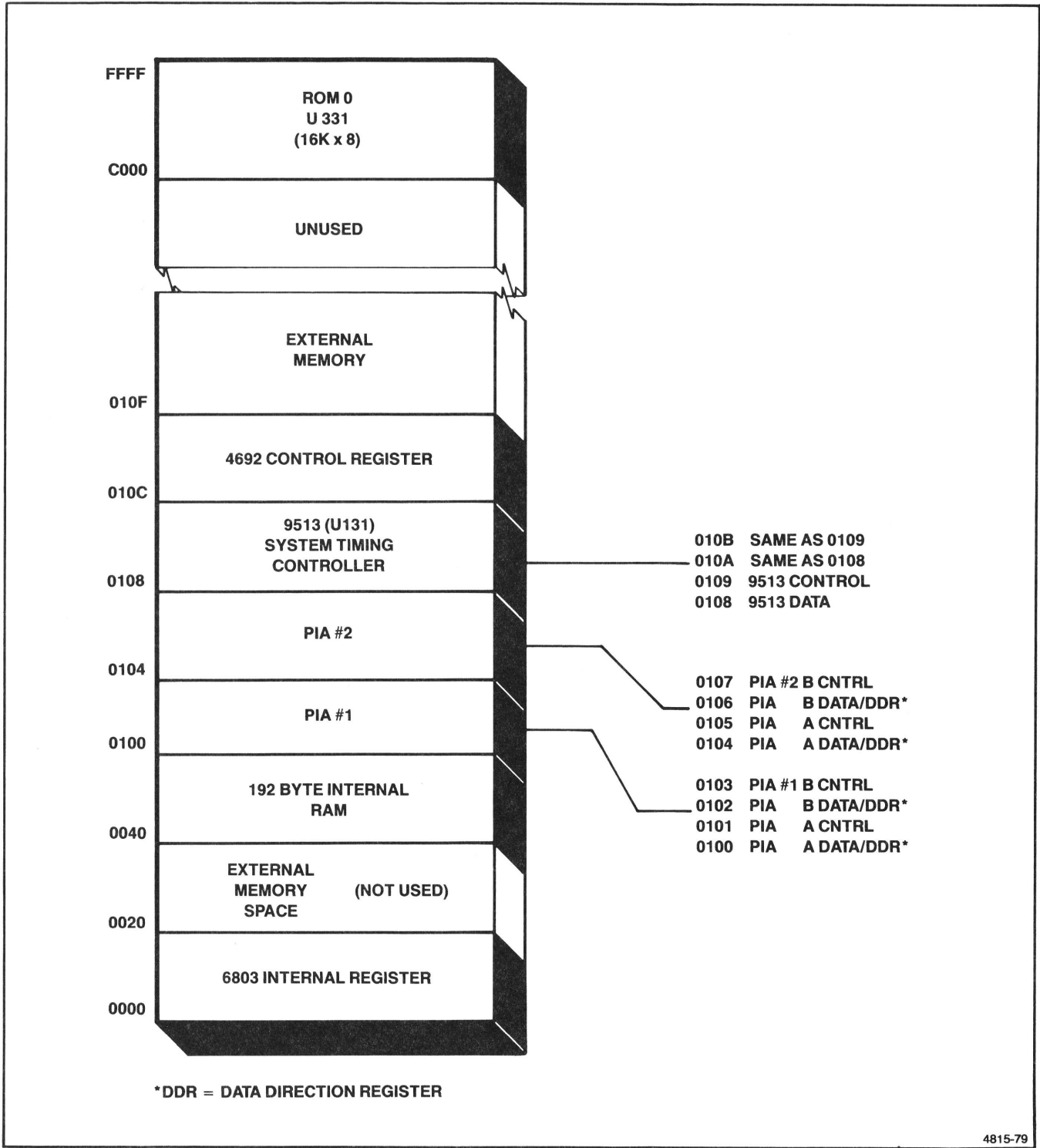


Figure G-2. Output Peripheral Interface Adapter Memory Map.

PRINT ENGINE MEMORY MAP



*DDR = DATA DIRECTION REGISTER

Figure G-3. Process Control Microprocessor Memory Map.

4815-79

Appendix H

MAJOR SIGNALS

INTRODUCTION

This appendix contains a list of the major signals, and a brief description of the use and purpose of each. Refer to Section 3, *Theory of Operation* for more information on the use and interplay of the major signals.

List of Signal Groups:

- Input Signals to the Parallel Interface
- Internal Control Signals from the Parallel Interface Processor
- Signals Common to Parallel Interface and Process Control
- Configurable I/O: Front Panel to Process Control
- Signals Common to Process Control and Drive Module
- Control Signals from PIA 2 of the Process Control Board

SIGNALS TO THE PARALLEL INTERFACE CONNECTOR

DSTB-0

A logic low data strobe for the transmitted data from the host. Data must be valid for 200 nsec before and after DSTB-0 asserts.

D0P1-D7P1, (D0P2-D702, D0P3-D7P3, D0P4-D7P4 — OPT. 02)

Input data buses from Ports 1 through 4. These buses carry the host's 8-bit command and data bytes to the copier. Refer to DSTB-0.

ACK-0

This logic low acknowledge signal tells the host that the copier has received the transmitted data.

BUSY-1

This active high signal informs the host that the copier is not yet available for the next transmitted byte or that the copier is servicing another multiplexer port (for multiplexer equipped copiers). While a copy is in process, this line informs any other host/terminal requesting service that the copier is busy. This signal is used in conjunction with FAULT-0 to indicate "hard" faults.

IR/SO

This line indicates, to the host, the copier's image relationship with respect to the media being utilized (the copier prints parallel to the long axis of the media). For the 4692 this line will always be a logic "1" except during a status request routine. During a status request, the copier sends a serially encoded 112 bit status message to the requesting host.

SELECT-1

This logic high control line from the copier to the host indicates, to the host, that a copier is attached to the interface cable. In the case of the 4692, the line implies that the copier is attached and functional.

FAULT-0

This line, used with the BUSY-1 line, indicates the interface status of the copier. Its assertion implies a fault indication of some type has occurred at the copier. The assertion of both FAULT-0 and BUSY-1 indicates a copier hardware failure or operator attention is required at the copier. The assertion of just FAULT-0 indicates a communication failure between the host and the copier.

For more information on these lines and the Tektronix Parallel Interface protocol consult the *4692 Color Graphics Copier Device Driver Development Guide*.

MAJOR SIGNALS

PARALLEL INTERFACE PROCESSOR INTERNAL CONTROL SIGNALS

INTERFACE PROCESSOR PORTS

The 6803 processor (U315) controls the data flow from the host to the copier mechanisms. This control is handled through two ports. The major signals to and from these ports are listed and explained below.

PORT1

PSTROBE-1

PORT STROBE-1 is an output from the processor which is used to initiate a Direct Memory Access (DMA) request, the subsequent DMA cycle stores, into the Line Buffer, the contents of the Line Buffer data latch. For PSTROBE-1 to be honored, the State Machine must be disabled and the DMA controller enabled (DGRNT asserted).

S1

S1 is an output which, used in conjunction with S2, sets the input multiplexer to the desired port. S1 is the Least Significant Bit of the two bits used to set the multiplexer.

S2

S2 is an output which, used in conjunction with S1, sets the input multiplexer to the desired port. S2 is the Most Significant Bit of the two bits used to set the multiplexer.

PACK-1

PORT ACKNOWLEDGE-1 is an output which, by using the processor, sends the "ACK" pulse to the host. PACK-1 and CACK-1 are "orred" together in the U405 to produce "ACK-1." PACK must be negated during image data transfer (while the State Machine is enabled) or whenever the port address is changed.

Xa (IR/SO PORT1)

P14 is an output to the host used to indicate the "Imaging Relationship" to the host on Port 1. It is also used to send status data back to the host.

Xb (IR/SO PORT2)

P15 is an output to the host used to indicate the "Imaging Relationship" to the host on Port 2. It is also used to send status data back to the host.

Xc (IR/SO PORT3)

P16 is an output to the host used to indicate the "Imaging Relationship" to the host on Port 3. It is also used to send status data back to the host.

Xd (IR/SO PORT4)

P17 is an output to the host used to indicate the "Imaging Relationship" to the host on Port 4. It is also used to send status data back to the host.

PORT2

SMEN-1

STATE MACHINE ENABLE-1 output enables and disables the state machine. When the line is disabled the state machine is held in state "A." When enabled the State Machine moves to it's next state depending upon inputs received.

TIMER-1

This output triggers the HEALTH LED one-shot. A low-high transition of this line causes the health one-shot to turn on the LED.

PCDSTB-1

This output clears the input data strobe filp-flops. This is the processor method of answering the "copy header" data sent from the host. It allows the processor to "handshake" each byte from the host. This signal must be negated while the State Machine is enabled or while port polling is active.

SIGNALS COMMON TO PARALLEL INTERFACE AND PROCESS CONTROL

YD0 – YD7

This 8 bit unidirectional data bus carries the color indexed pixel data received from the image source. Each byte represents one pixel of image information.

DRQ-1

DATA REQUEST-1, issued to the interface DMA by the Process Control module, indicates that the information for the next pixel is required. Data is expected within 47us of DRQ-1 assertion. DRQ-1 is cleared by DACK-0.

DACK-0

DATA ACKNOWLEDGE-0 is the data strobe for YD0–YD7. It is also used to clear DRQ-1.

MCK

MASTER CLOCK is a buffered 4Mhz clock common to the Process Control 6803 microprocessor.

RESET-0

SYSTEM RESET-0 is used to force a known state to the Parallel Interface board. The signal is held long enough to ensure that the power supplies attain their nominal voltage.

TDX and RDX

This is used as the communication link between the microprocessors on the Parallel Interface board and the Process Control board.

MEMORY ADDRESS OF INTERFACE LINE BUFFERS

The Line Buffer has two 8K assigned memory areas. Only 2K of memory space allotted for each line. This address space is accessed through the 6844 DMA control chip.

1. First line buffer 0000 – 1FFF. The hardware straping is configured for installation of 6116 (2Kx8) RAM.
2. The second line buffer exists from 2000 – 3FFF and accommodates a 6116, (2Kx8) RAM.

U115 (PIA 1) SIGNALS

Below are listed the I/O registers for the PIA. Each register is divided into the control signals which it outputs. The bits for each register are defined by signal function and the active state of each signal is shown.

PORT A — INPUT PORT

PA0 – PA7

PORT A is configured as an input port in the normal working mode of the copier. It is used to input data from the multiplexed data bus in order to act upon commands and data received. It is the input port from the multiplexed data bus, which is set by the S1 and S2 control lines from the processor.

In the "selftest" mode PORT A is configured as all outputs and is used to write data to the Line Buffer in order to test the State Machine and Pixel Formatter.

MAJOR SIGNALS

PORT B – CONTROL SIGNALS

PDSTB-1

PORT DATA STROBE-1 is an input used to determine whether a strobe has occurred from the parallel interface port selected by S1 and S2 port address lines. It, in essence, is a flag which is set when a data strobe is received from the host. It is reset by the Processor Kernel "PCDSTB" signal or the State Machine's CDSTB signal.

TPB-1

TWO PIXEL/BYTE-1 controls the formatting of the incoming pixel data from the host. When in the active state the two pixels per byte mode (1 bit/primary) of data transmission is set for the interface. Negation of SBYTE (PB5) and TPB places the Pixel Formatter in the two bytes per pixel mode (4 bits/primary).

VALMUX-0

VALMUX-0, when active, causes the multiplexer's output to be asserted. The VALMUX signal deasserts during changing of the interface multiplexer to insure no false signals are generated by the setting of the multiplexer. Negating VALMUX while changing port addresses is optional with the prerequisite that the State Machine is disabled and PACK is negated.

CMPEN-1

COLOR MAP PROM ENABLE-1 is an output which, in the asserted state, enables the Color Map PROM's outputs to the Line Buffer. In essence, it controls the data latch to the Line Buffer.

DGRNT-0

DMA GRANT enables the DMA, MC6844 for data transfer. Negation of DGRNT disables DMA activity and memory maps the DMA controller into processor memory space.

SBYTE-1

SINGLE BYTE-1 enables the IF State Machine for the single byte (2 bits/primary) mode of data transmission. Negation of SBYTE-1 and TPB-1 places the IF State Machine in the two bytes per pixel mode (4 bits/primary).

IOENABLE-0

IOENABLE-0 enables the writing of data from the line buffer data latch to the line buffer. This line is used when performing a self test of the Line Buffer RAM.

RASCEN-1

RASCEN-1, when enabled, allows the State Machine to output the required "ACK" back to the host for each data byte received. Host acknowledgment on a per data byte basis during handshake mode image data transfer is a hardware function and is enabled only for (RASCEN*S-MEN). When data transferring in "streaming" mode, RASCEN-1 must be negated.

SELECT-0

SELECT-0 informs the host through the "select" line that the copier is attached to the cable.

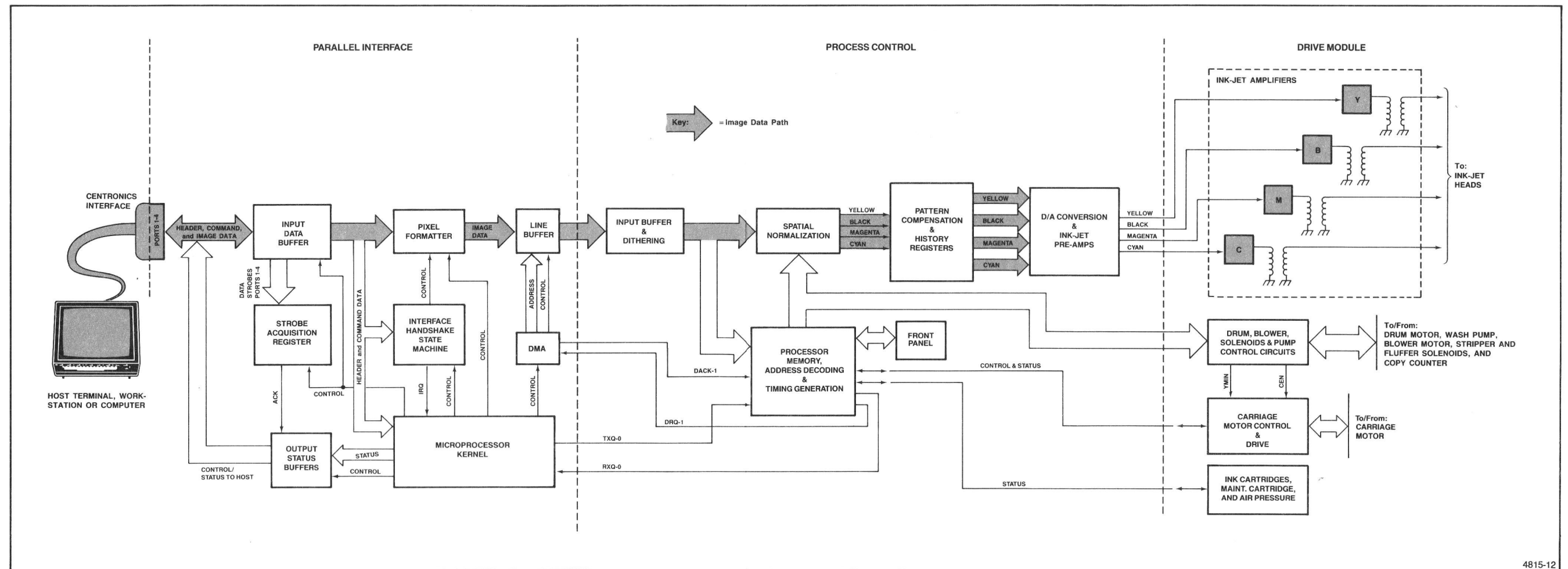
SELFTEST-1

SELFTEST-1 sets up the interface board's muxed lines for an internal selftest. It does the following:

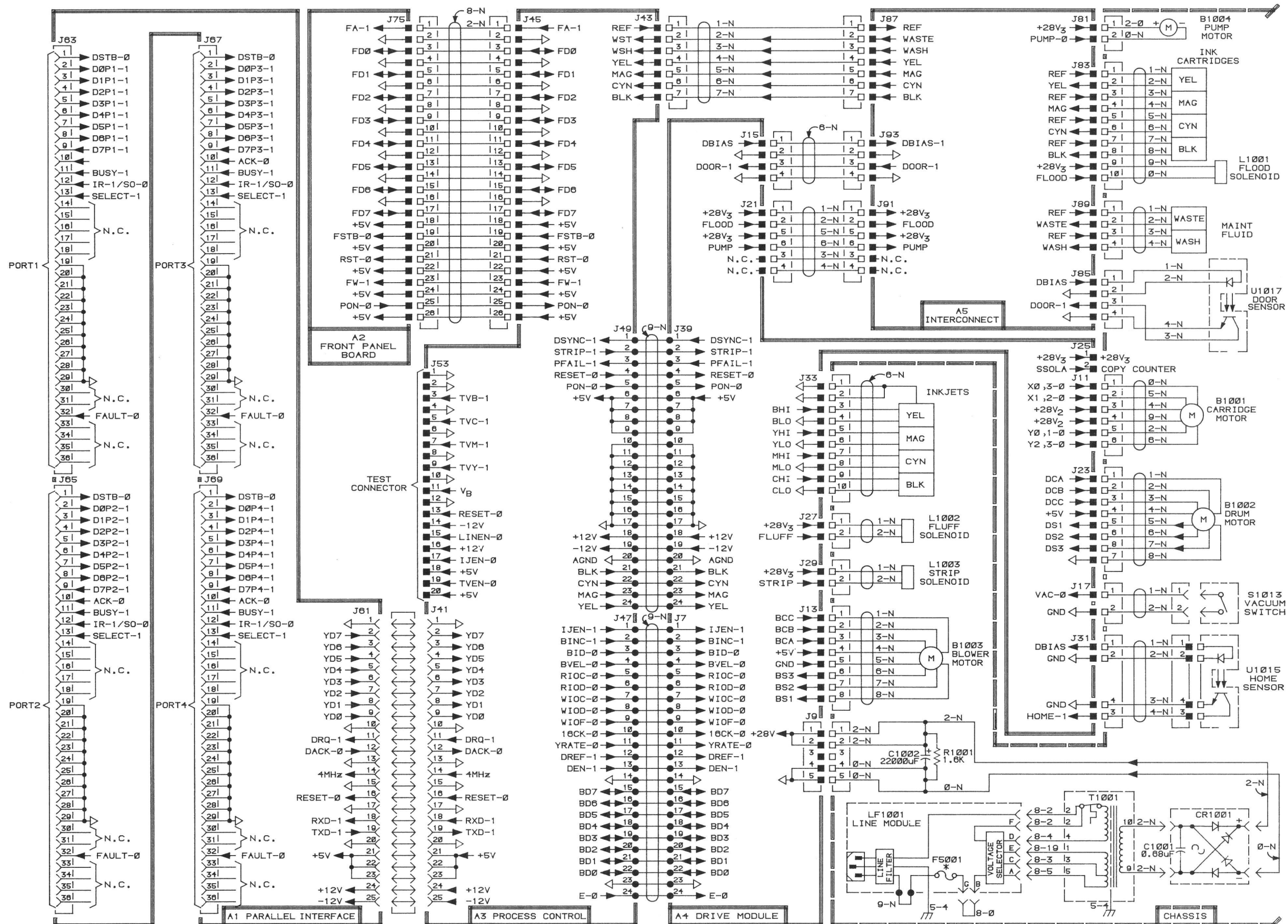
- The four parallel input port data latches are disabled to the muxed internal data bus.
- The external "DSTB-0" from the host is disabled and any strobes output from the IR/SO lines are rerouted and set the incoming data strobe flip-flops. The IR/SO lines can then be used to strobe data into the interface by duplicating the DSTB-0 inputs.

BXC-0

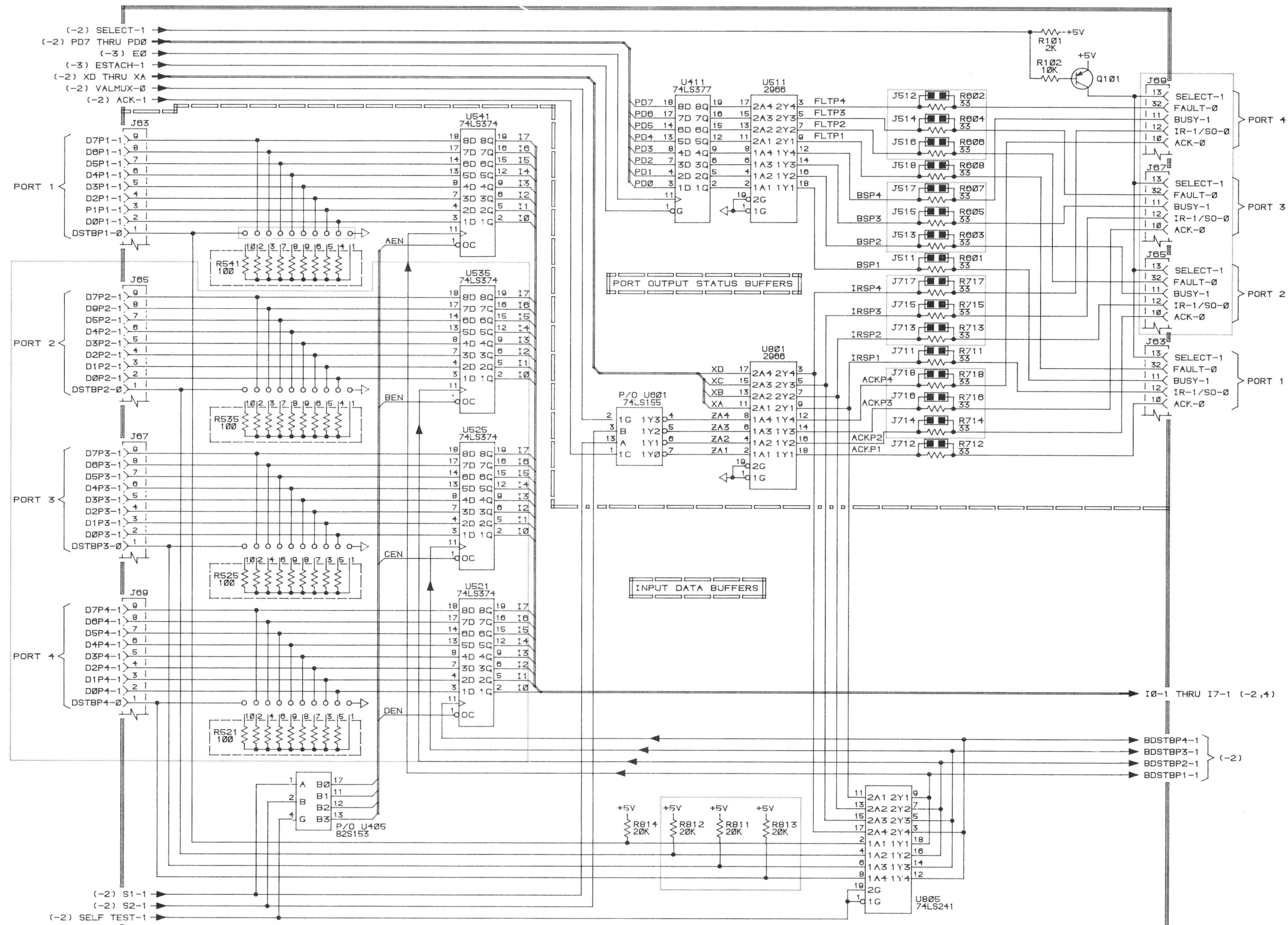
BLOCK-TRANSFER-COMPLETE is an input indicating the data "Block Transfer" is complete. It causes the IRQB output of the PIA to assert when a block transfer from the DMA is complete. This circuitry is part of the line padding feature of the parallel interface specification. RQB toggles to a low when the block of data has been transferred by the DMA. This low transition disables any more transmit requests from the Print Engine, as required by the hardware circuitry in the Print Engine for the line padding feature.



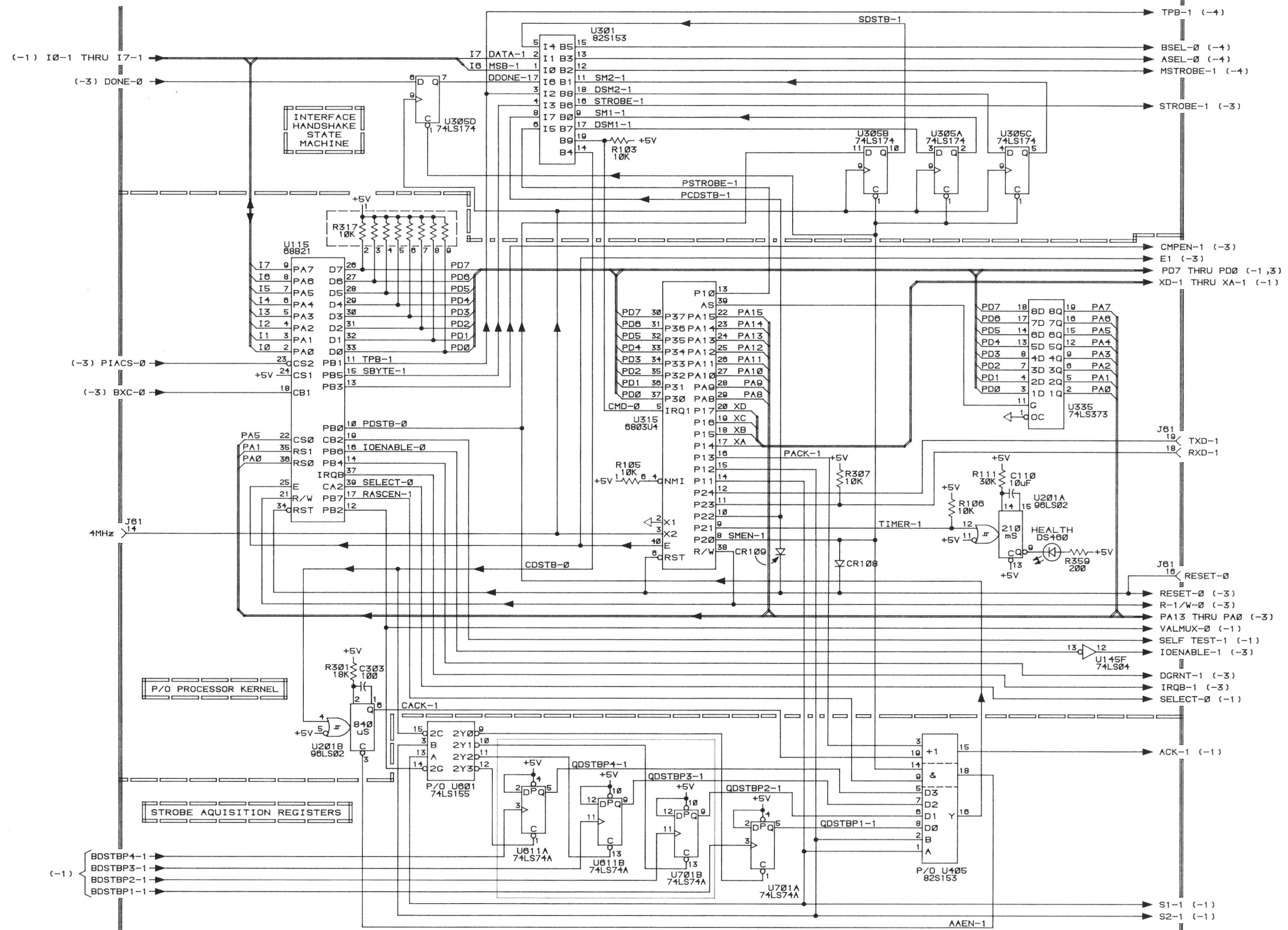
4815-12

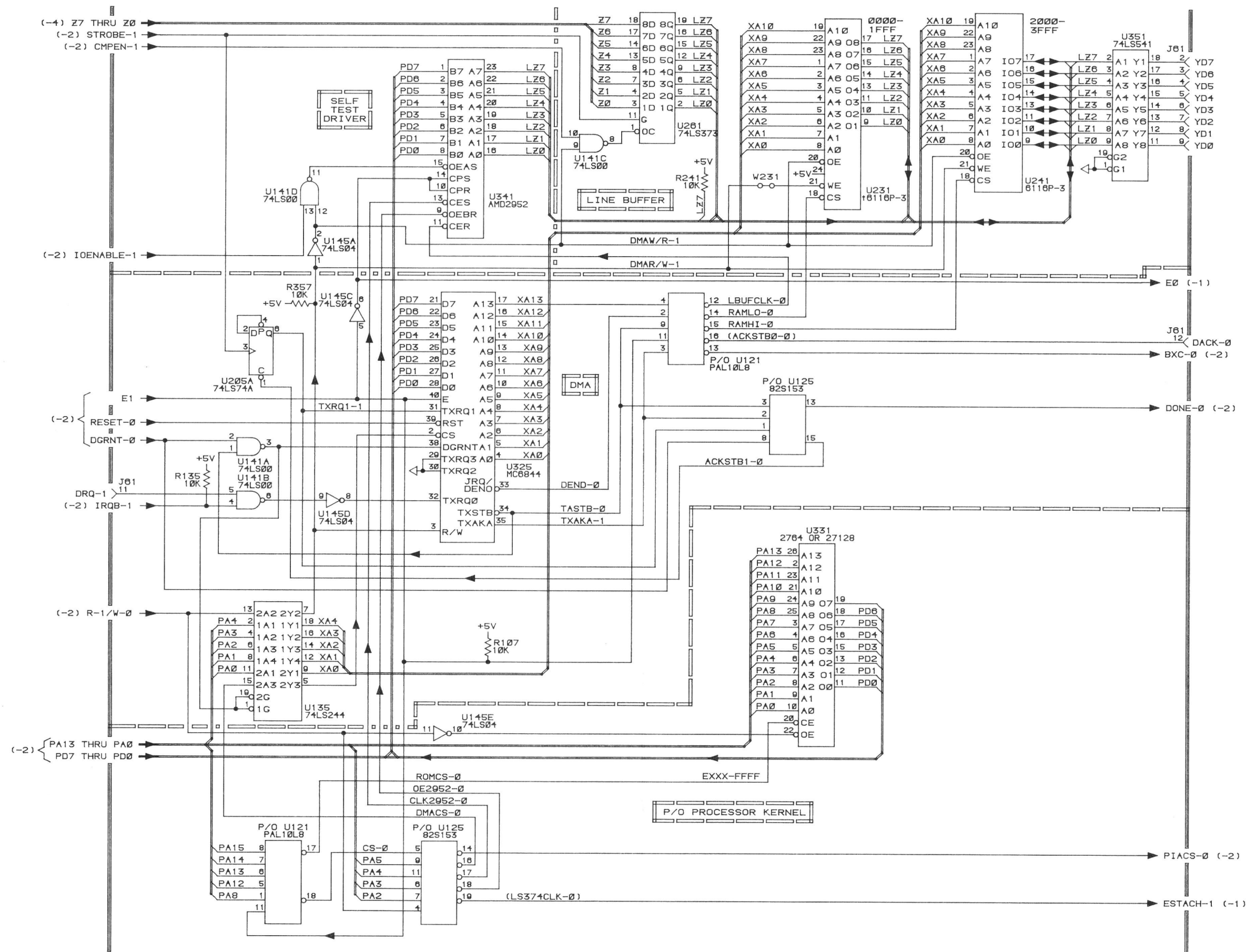


4815-117



FIRST USE:	4692	OTHER USES:	NOTES: * GREY AREAS OF SCHEMATIC APPLY ONLY TO THIS BOARD P/O = PART OF	TITLE: 670-8072-00 / *670-8745-00	ASSEMBLY:
DATE:	REV, 21 SEP 84			PARALLEL INTERFACE	A1-1
CONTROL NO.:	SPA006.000		TEKTRONIX, INC. © 1984		SHEET: 1 OF 4





FIRST USE: 4692
 DATE: REV, 21 SEP 84
 CONTROL NO.: SPA006.000

OTHER USES:

NOTES: * REFER TO THEORY OF OPERATION.
 P/O - PART OF

TEKTRONIX, INC. © 1984

TITLE: 670-8072-00 / 670-8745-00

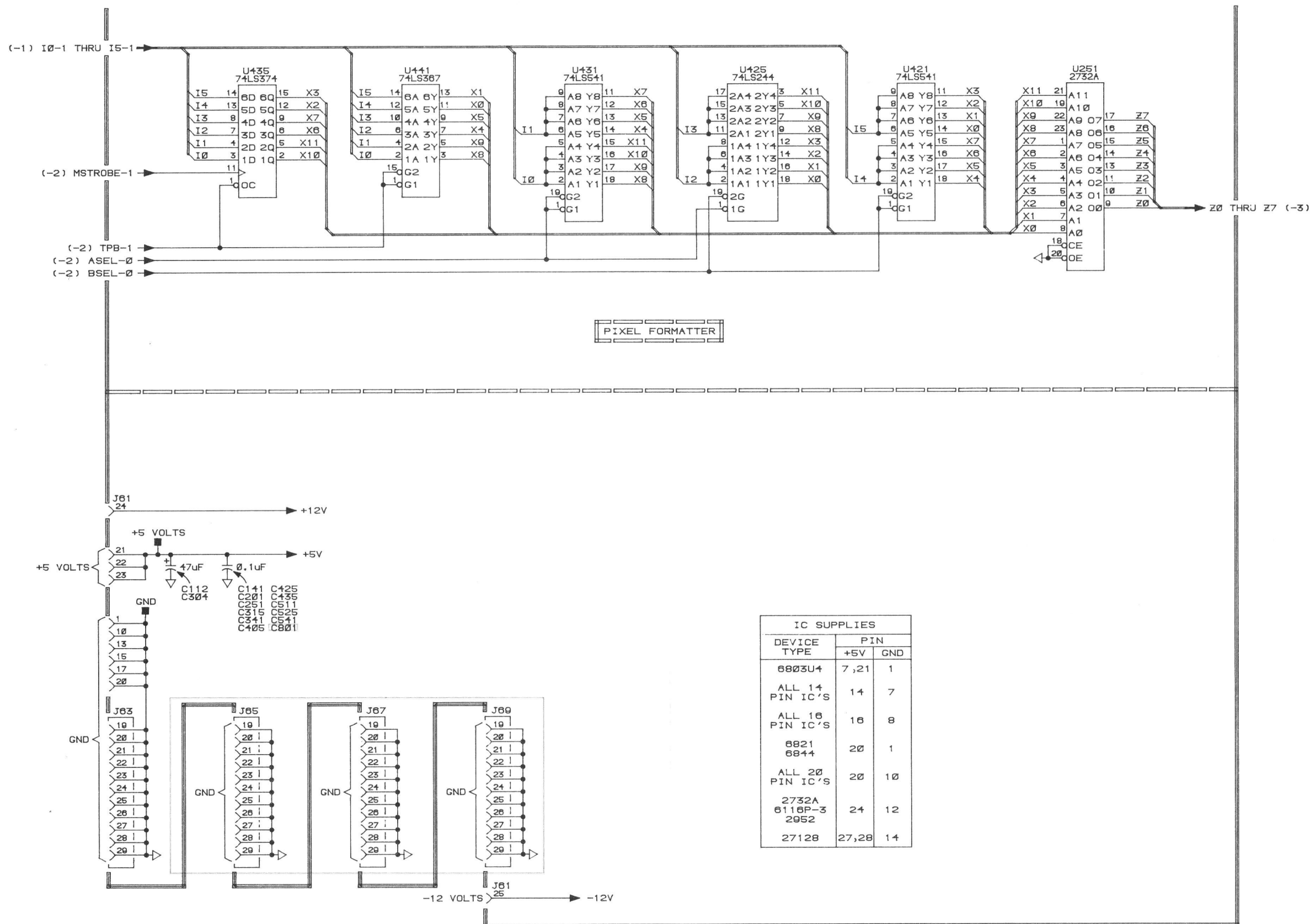
PARALLEL INTERFACE

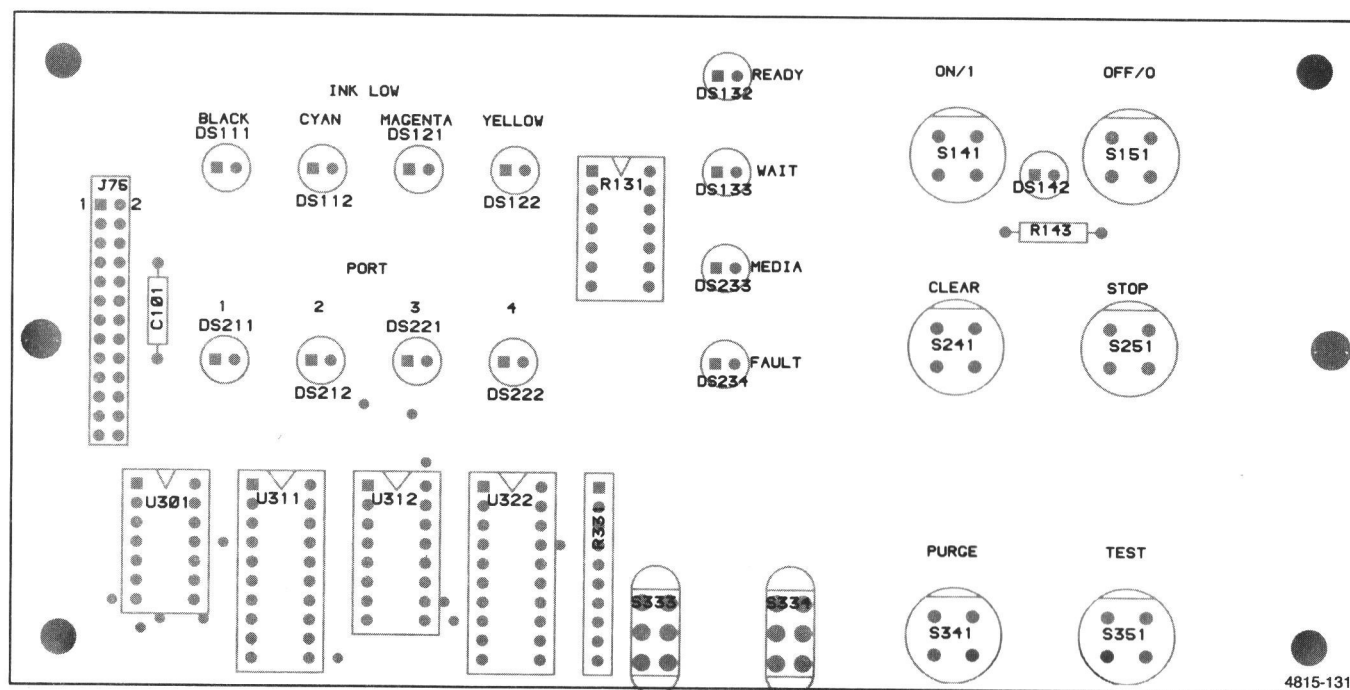
Tektronix®

ASSEMBLY:

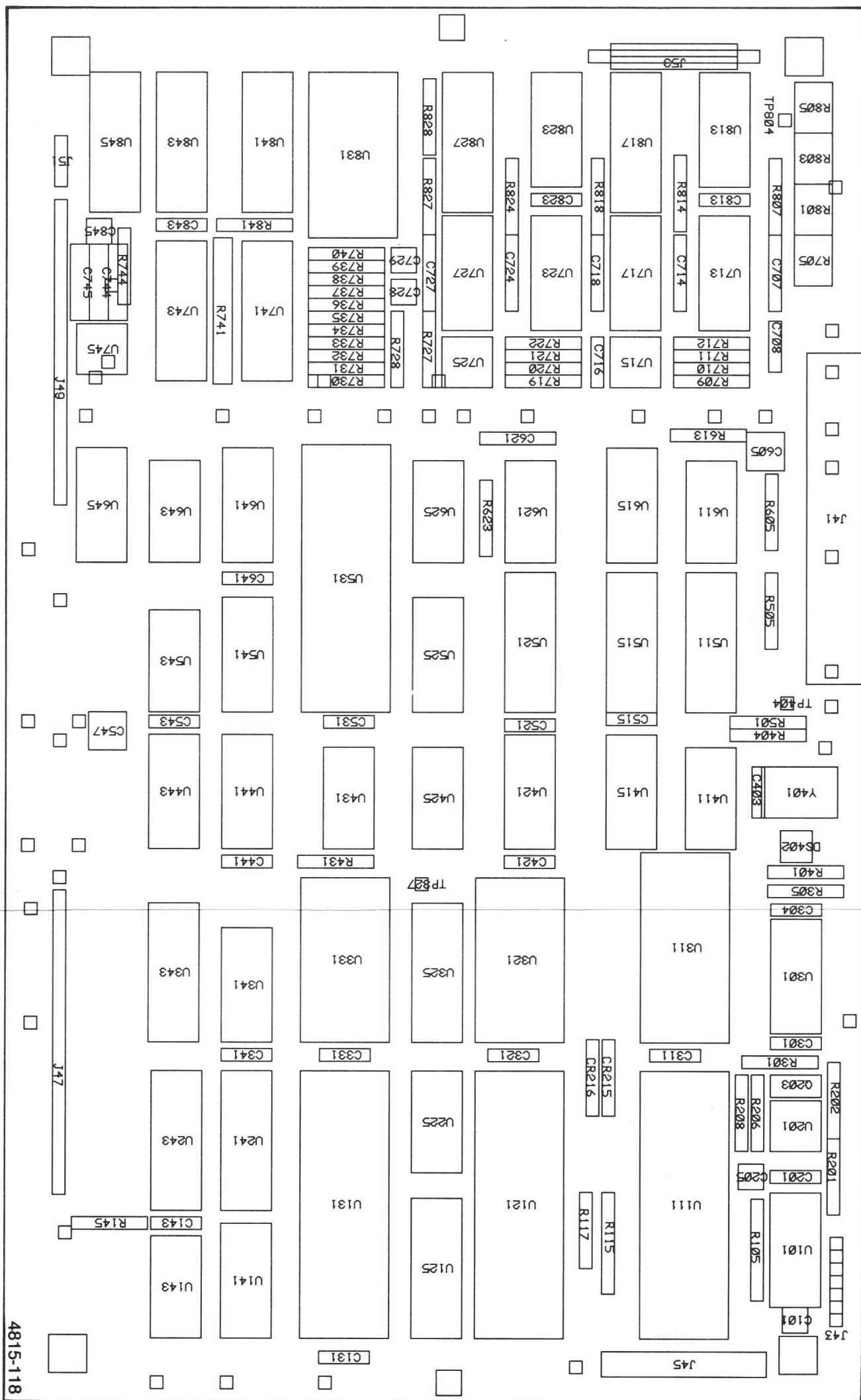
A1-3

SHEET: 3 OF 4



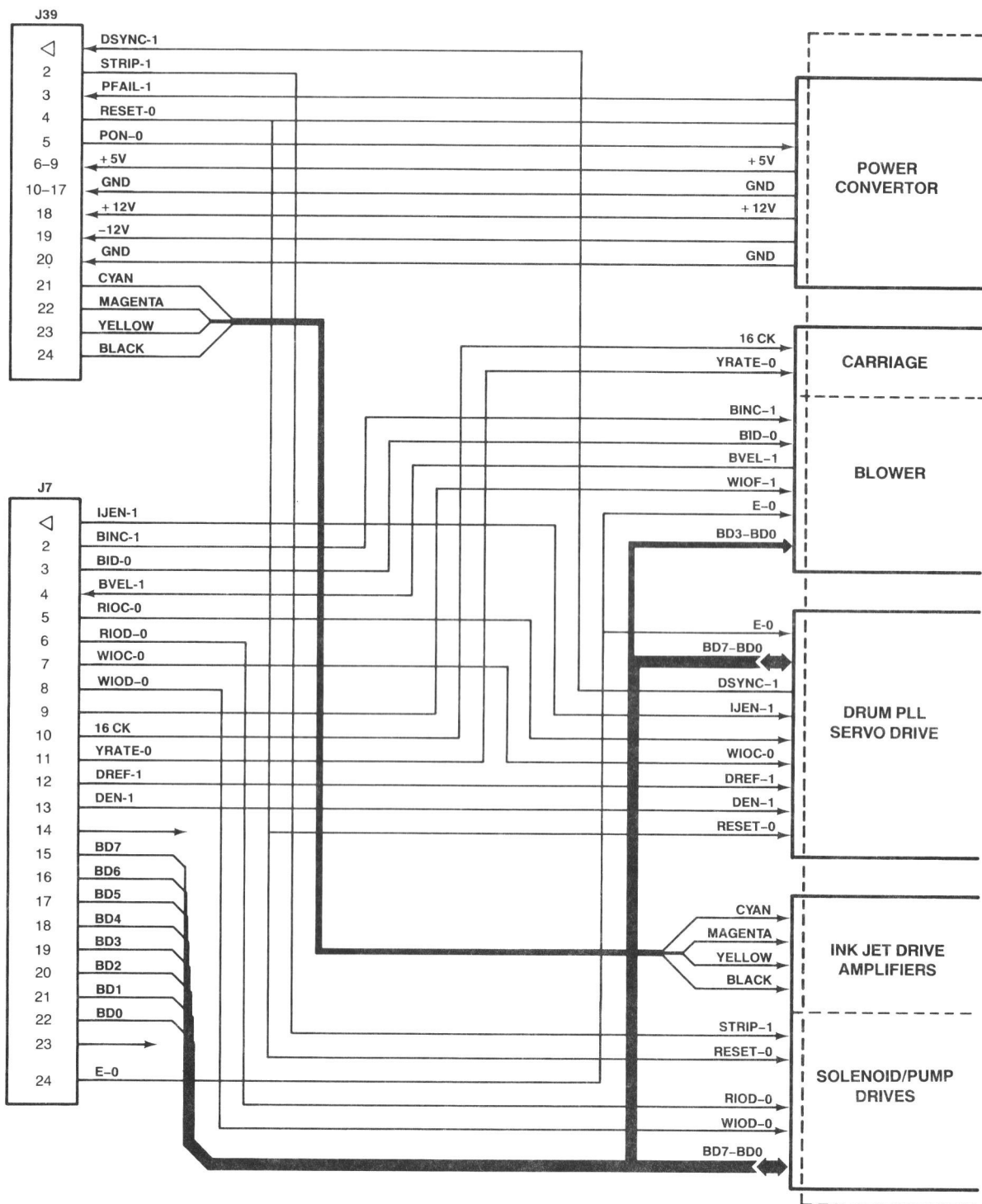


Front Panel (670-4651-00) Component Locations.



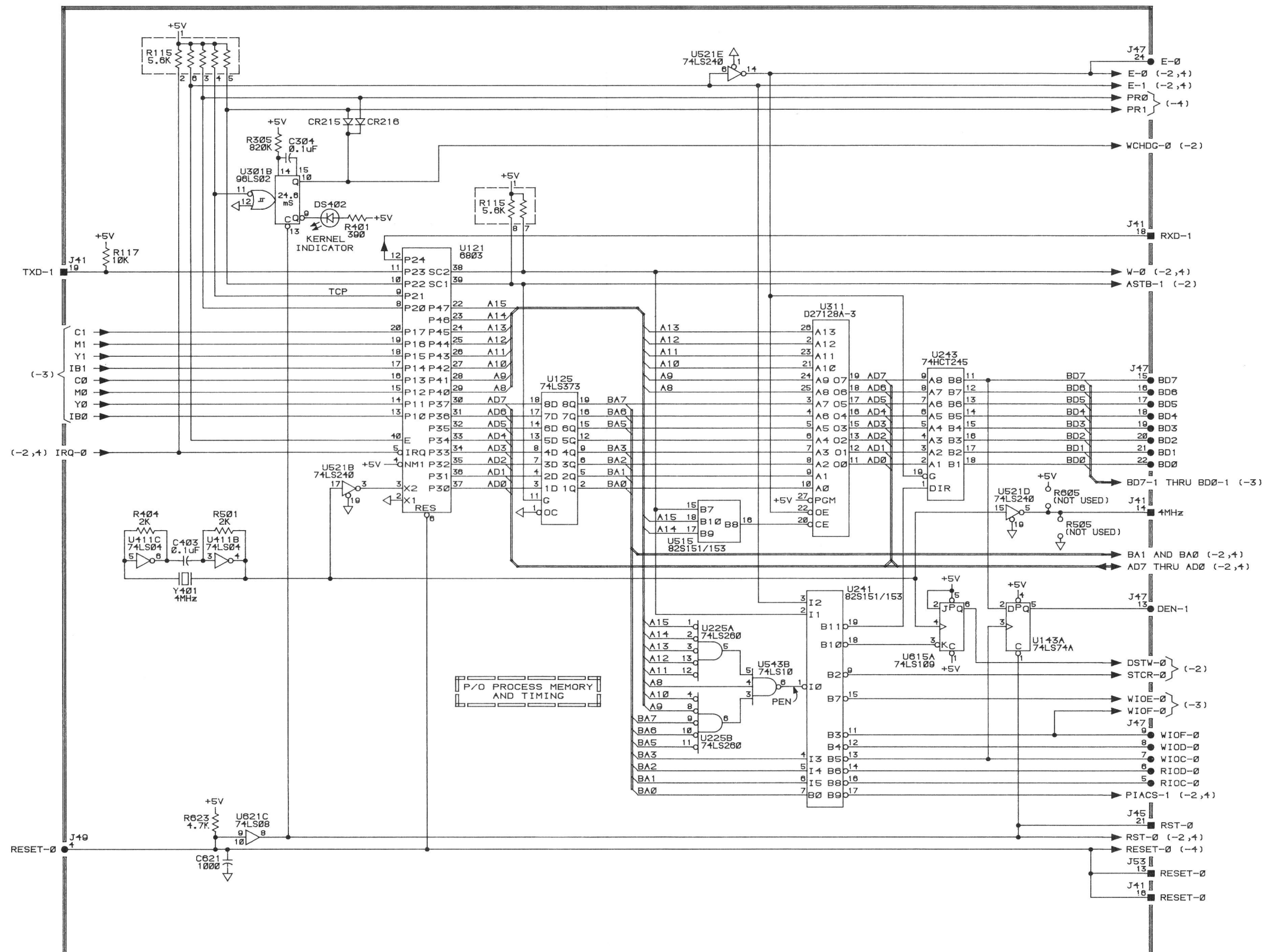
Process Control (670-8067-00) Component Locations.

4815-118

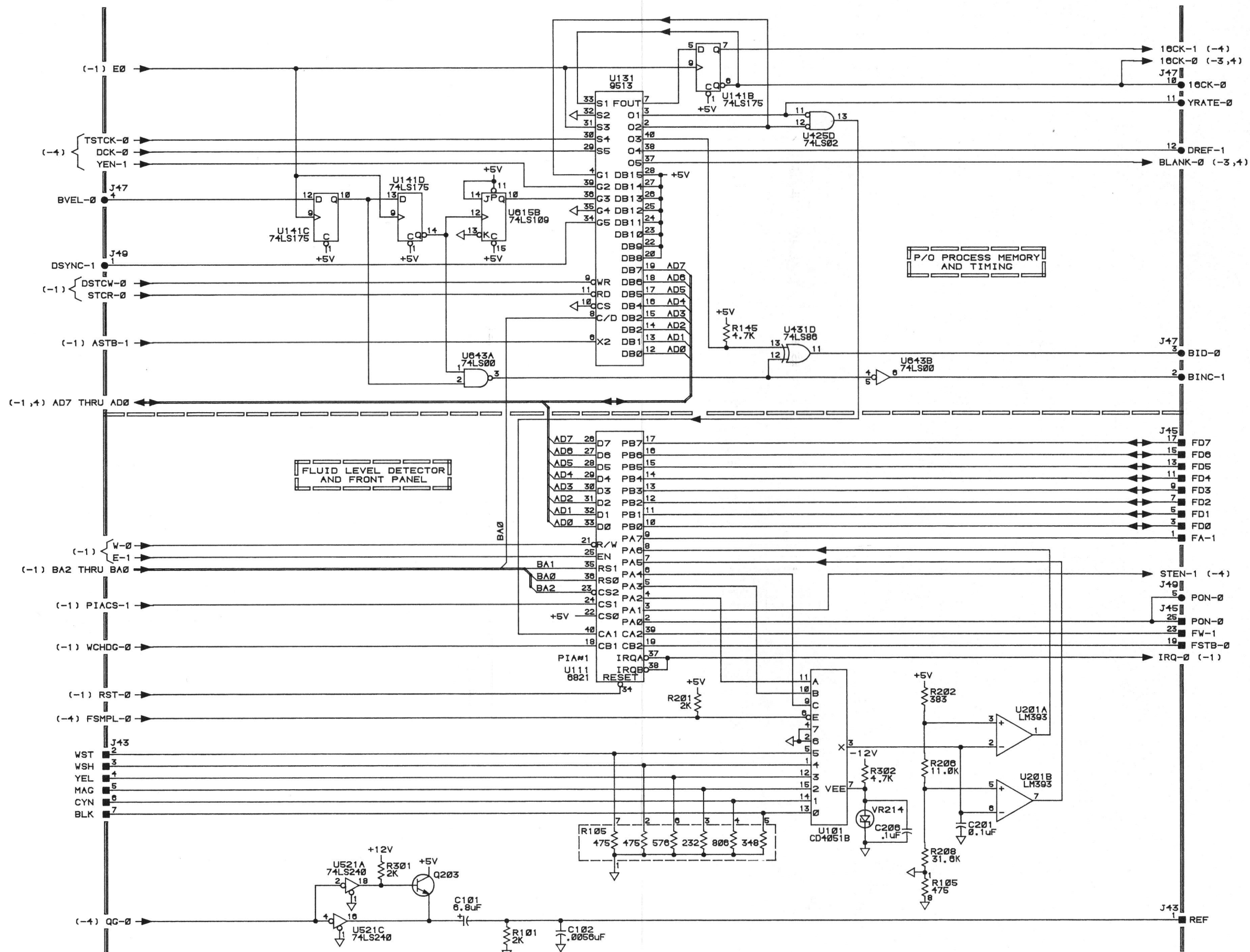


4815-114

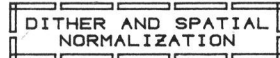
Process Control/Drive Module Interconnect.




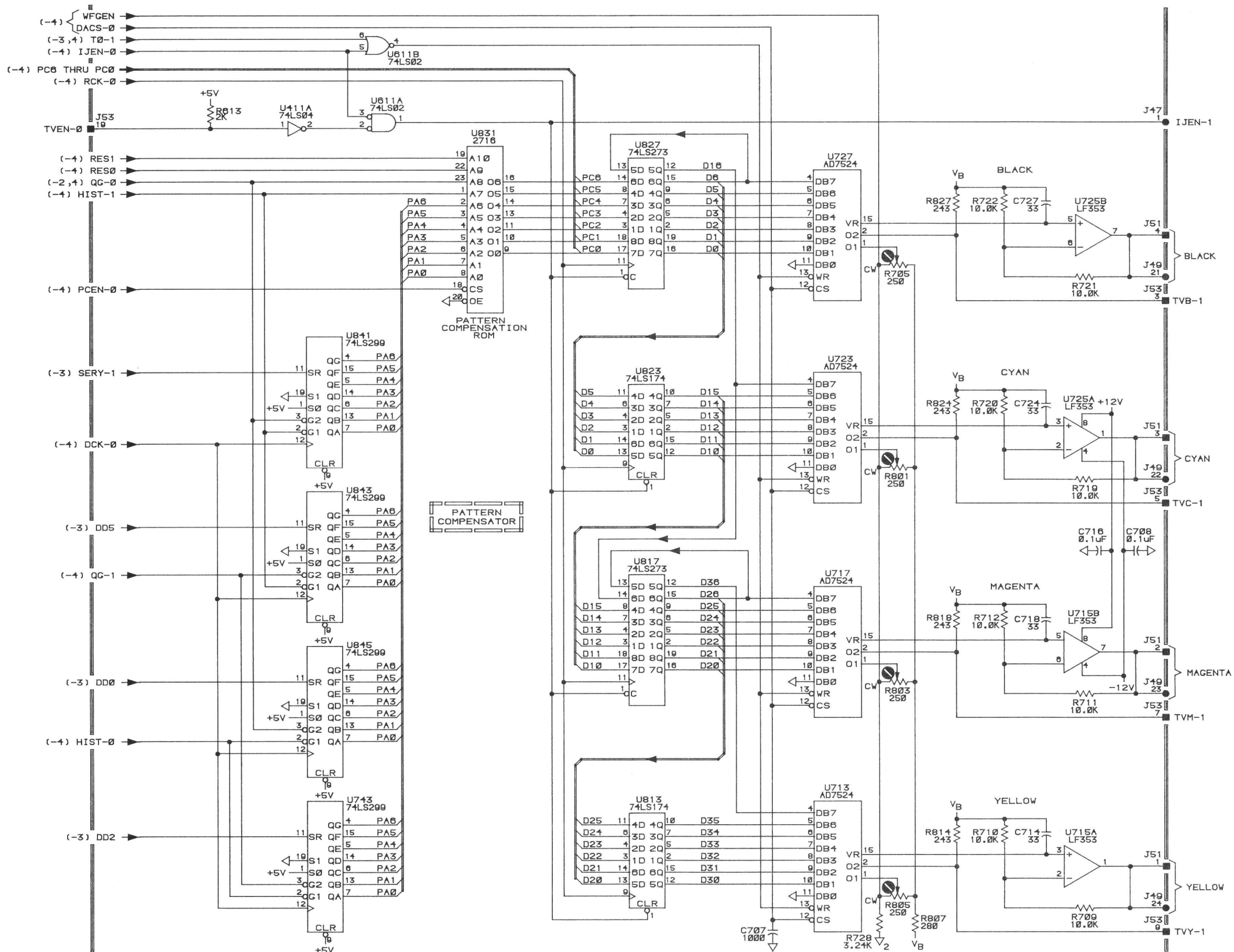
FIRST USE:	4692	OTHER USES:	NOTES:	TITLE: 670-8067-00	ASSEMBLY:
DATE:	REV, 27 SEP 84		P/O - PART OF	PROCESS CONTROL	A3-1
CONTROL NO.:	SPA002.000		TEKTRONIX, INC. © 1984		SHEET: 1 OF 6



FIRST USE: 4692	OTHER USES:	NOTES: P/O - PART OF	TITLE: 670-8067-00	Tektronix®	ASSEMBLY: A3-2
DATE: REV, 27 SEP 84			PROCESS CONTROL		SHEET: 2 OF 6
CONTROL NO.: SPA002.000		TEKTRONIX, INC. © 1984			



FIRST USE: 4892	OTHER USES:	NOTES:	TITLE: 670-8067-00		ASSEMBLY:
DATE: REV, 27 SEP 84		P/O - PART OF	PROCESS CONTROL		A3-3
CONTROL NO.: SPA002.000		TEKTRONIX, INC. © 1984			SHEET: 3 OF 6



FIRST USE: 4692
 DATE: REV, 27 SEP 84
 CONTROL NO.: SPA002.000

OTHER USES:

NOTES:

TEKTRONIX, INC. © 1984

TITLE: 670-8067-00

PROCESS CONTROL

Tektronix®

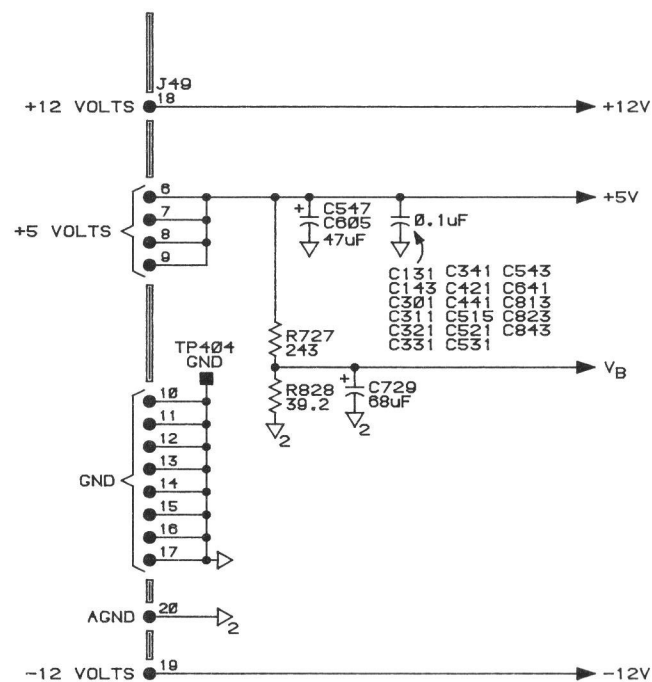
ASSEMBLY:

A3-5

SHEET: 5 OF 6

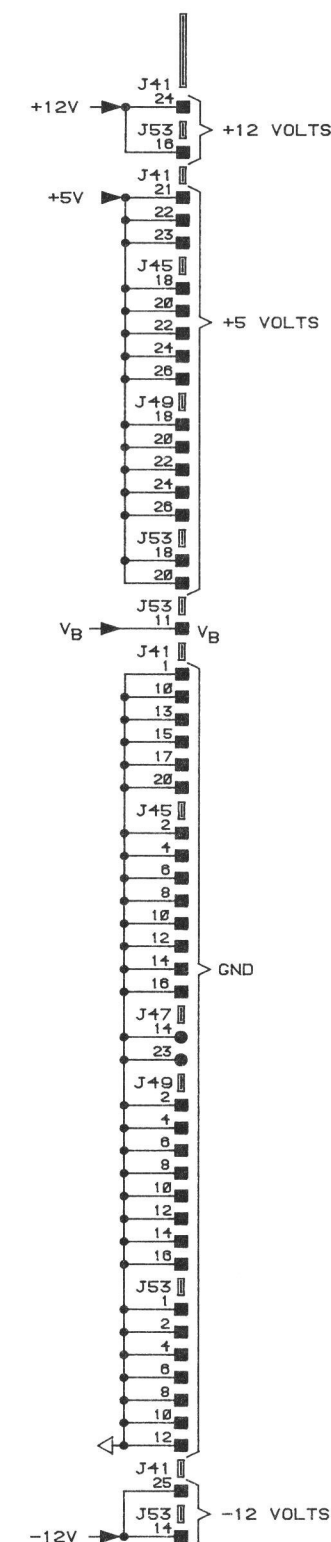
PROCESS CONTROL
 670-8067-00

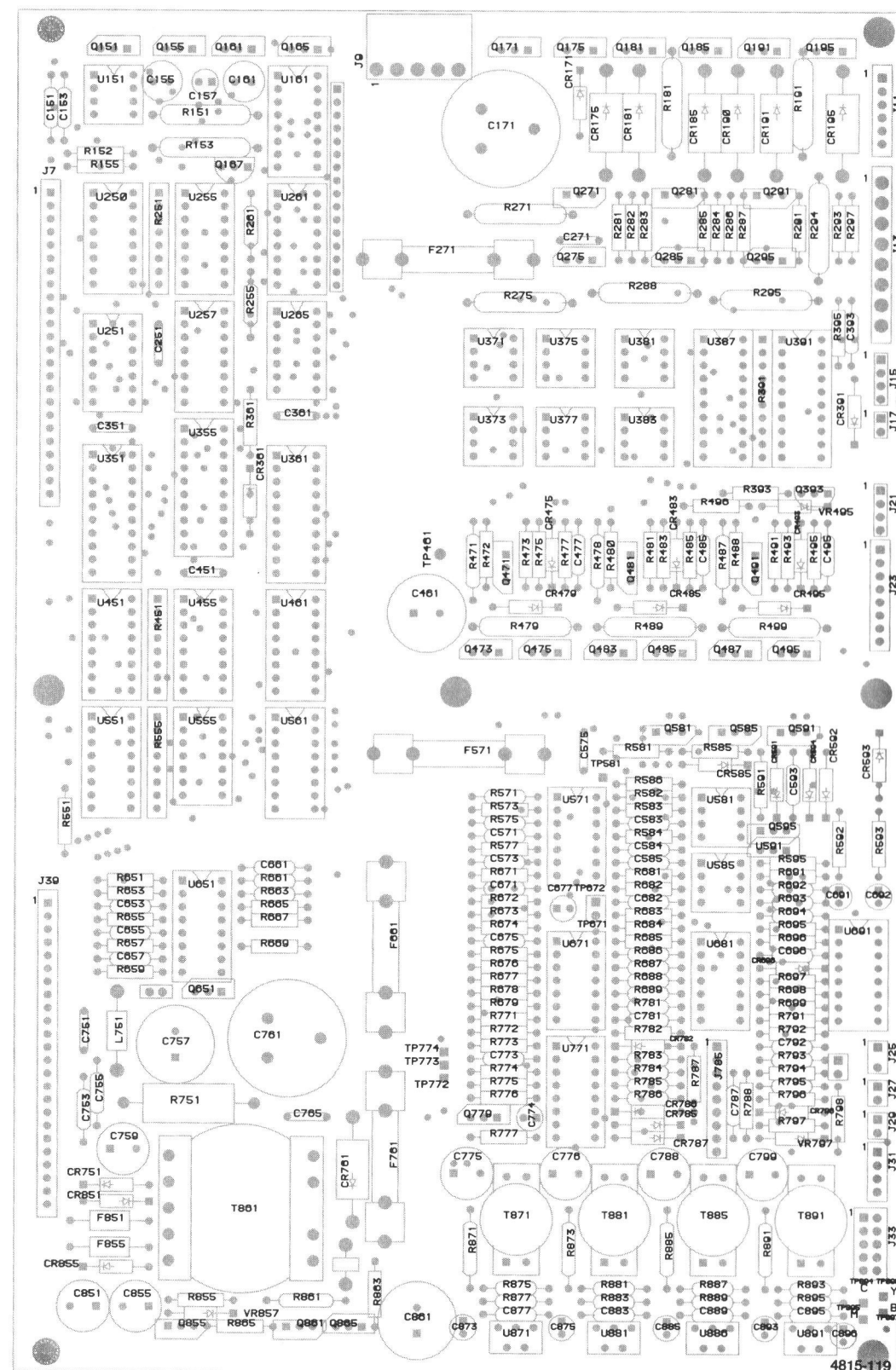
A3-5



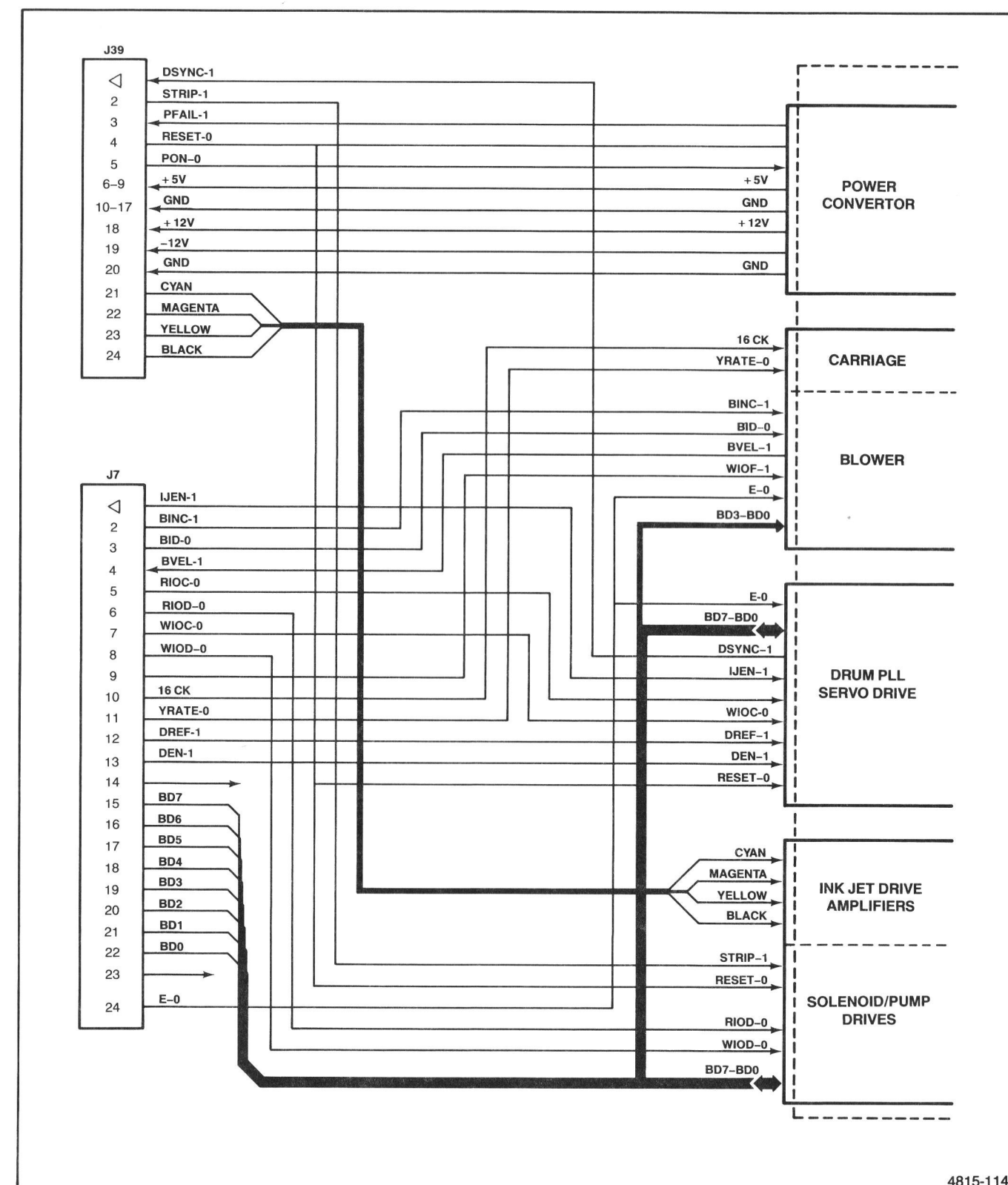
U645
(NOT USED)
1 18 +5V
2 15
3 14
4 13
5 12
6 11
7 10
8 9

DEVICE TYPE	PIN			
	+12V	+5V	GND	-12V
9513	-	1	21	-
2764-4 27128-4	-	1,28	14	-
6803	-	7,21	1	-
LM351	7	-	-	4
LM353	8	-	-	4
LM393	8	-	4	-
AD7524	-	14	3	-
OTHER 14 PIN IC'S	-	14	7	-
OTHER 16 PIN IC'S	-	16	8	-
6821	-	20	1	-
OTHER 20 PIN IC'S	-	20	10	-
2716	-	21,24	12	-
6810	-	24	1	-

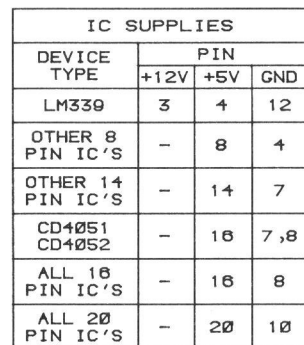


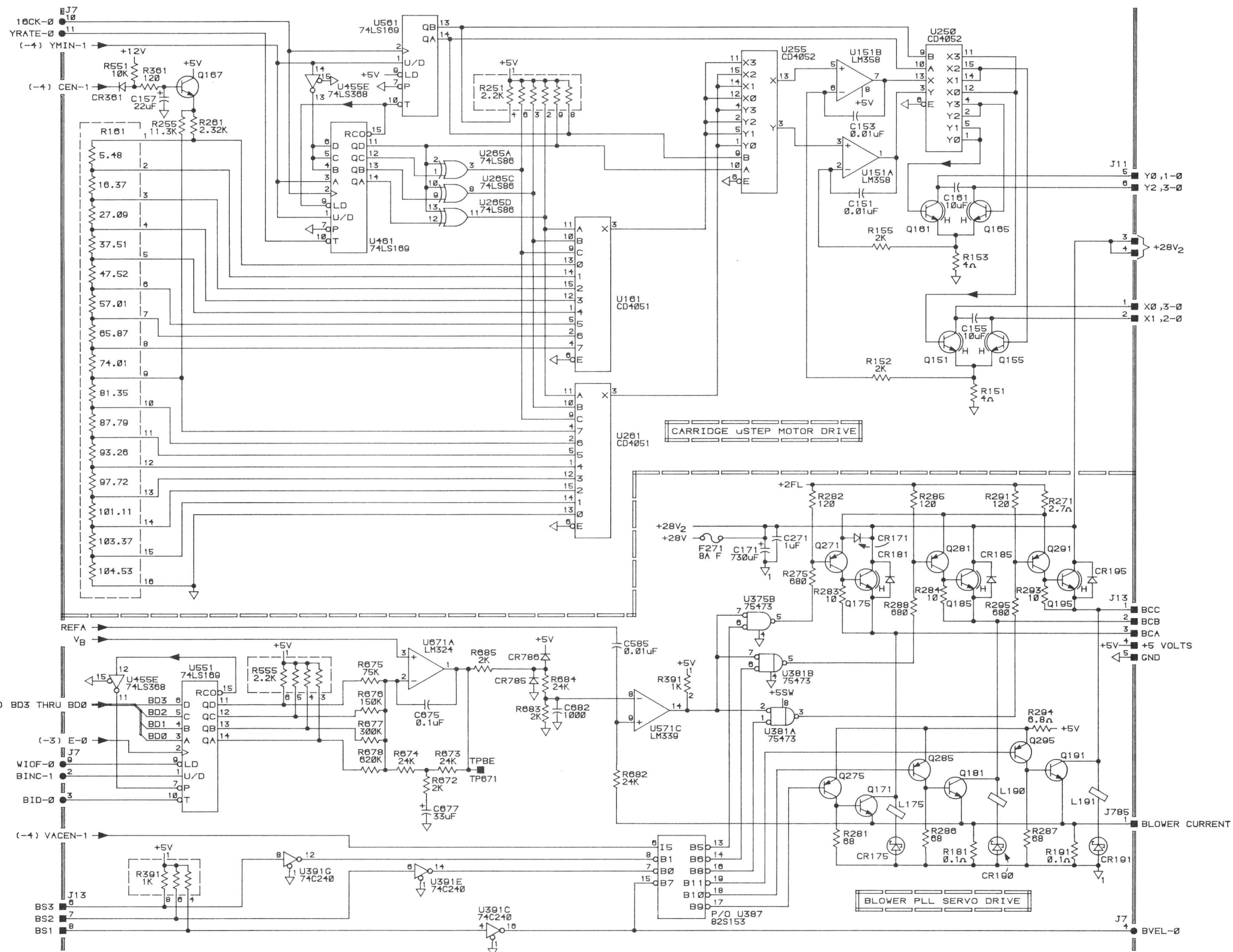


Drive Module (679-8733-00) Component Locations.

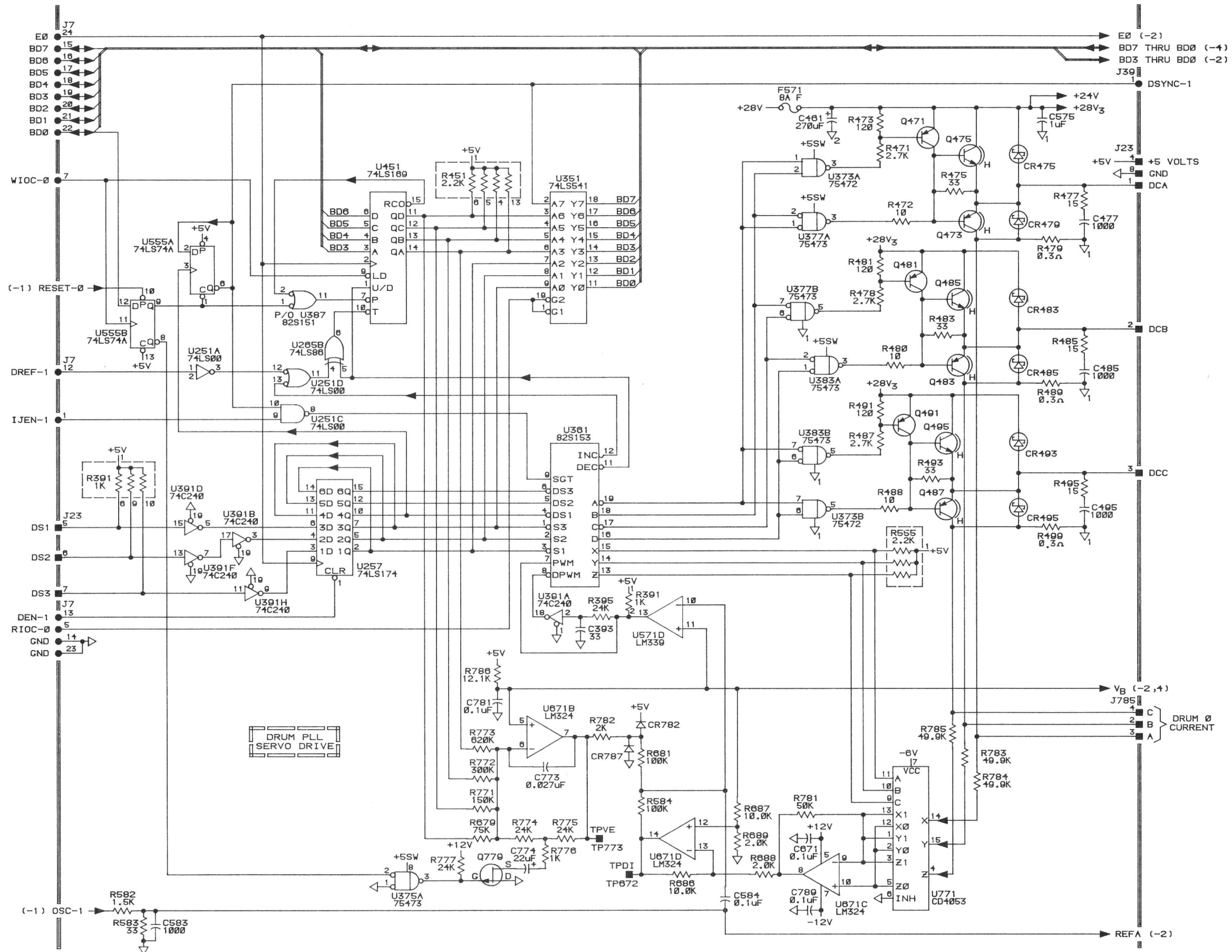


Process Control/Drive Module Interconnect.





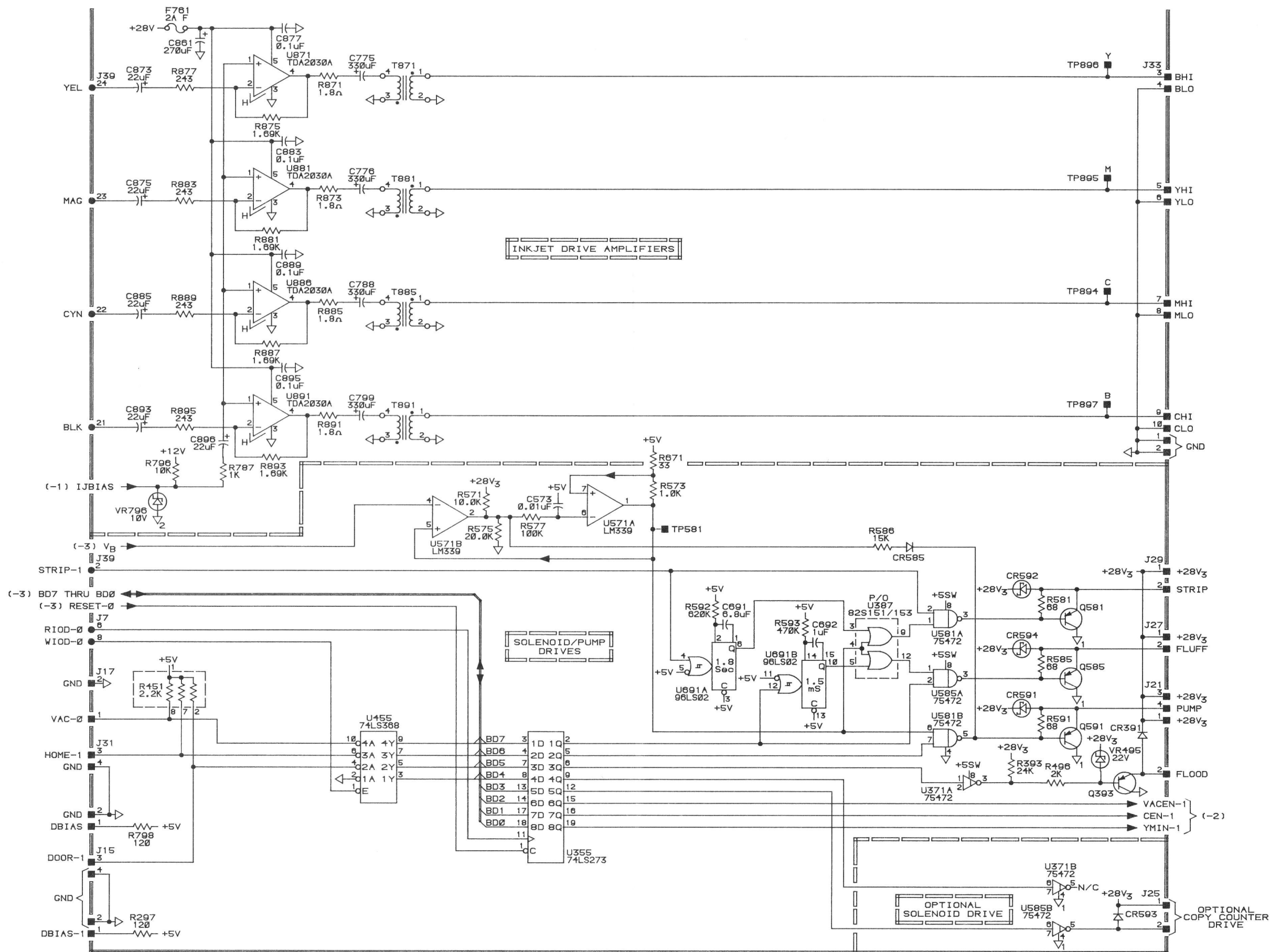
FIRST USE:	4692	OTHER USES:		NOTES:		TITLE: 670-8733-00	ASSEMBLY:
DATE:	REV, 27 SEP 84					DRIVE MODULE	A4-2
CONTROL NO.:	SPA004.000				TEKTRONIX, INC. © 1984		SHEET: 2 OF 4



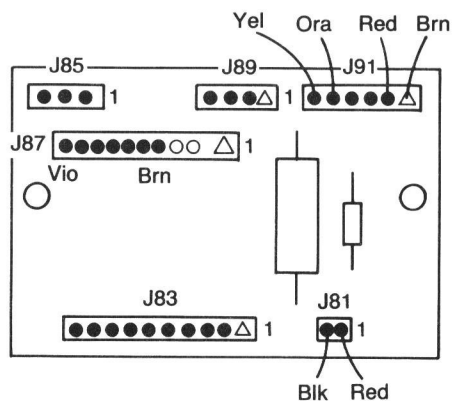
FIRST USE:	4692	OTHER USES:	NOTES:	TITLE: 670-8733-00	ASSEMBLY:
DATE:	REV, 27 SEP 84			DRIVE MODULE	A4-3
CONTROL NO.:	SPA004.000				SHEET: 3 OF 4

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Tektronix



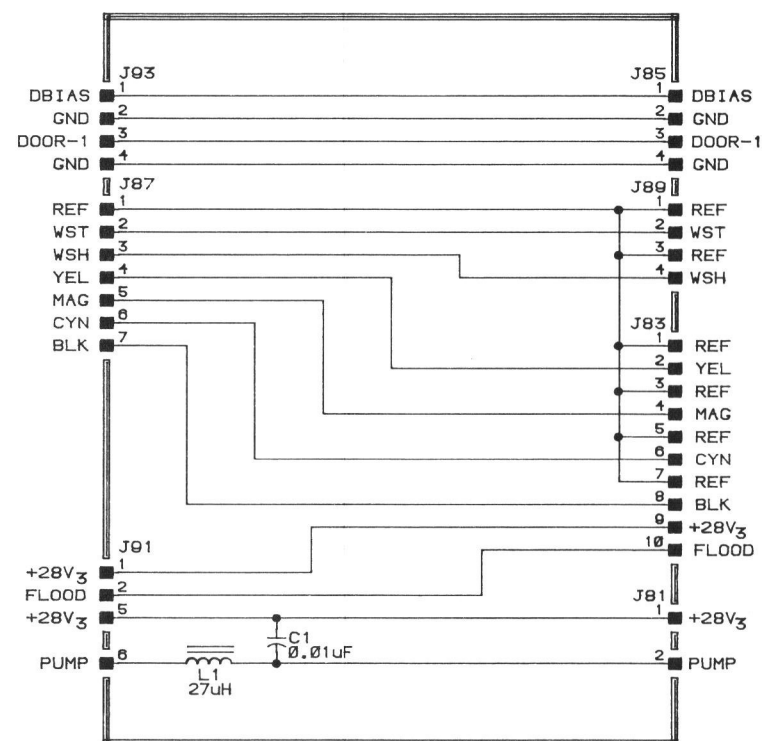
J81	Wash Pump
J83	Ink Cartridges and Flood (Wash) Solenoid
J85	Door Switch
J87	Front Panel
J89	Maintenance Liquid Cartridge
J91	Power Supplies and Solenoid Controls from Drive Module



INTERCONNECT BOARD

4815-116

Interconnect (670-8346-00) Component Locations.



FIRST USE:	4692	OTHER USES:	NOTES:	TITLE: 670-8346-00		ASSEMBLY:
DATE:	REV, 28 JUN 84			INTERCONNECT BOARD		A5-1
CONTROL NO.:	SPA003.000		TEKTRONIX, INC. © 1984			SHEET: 1 OF 1

Appendix A

ACCESSORIES AND SUPPLIES

INTRODUCTION

The following lists the standard accessories, optional accessories, and supplies needed to operate the copier on a day-to-day basis. Standard accessories are packaged with the copier shipping container.

STANDARD ACCESSORIES

<i>4692 Color Graphics Copier Operators Manual</i>	070-4816-00
Power Line Cord, 115 Volt	161-0066-00
Media Input Tray (used for both A-size and A4-size media).	436-0172-01
Media Output Tray (used for both A-size and A4-size media).	436-0189-00

OPTIONAL ACCESSORIES

<i>4692 Color Graphics Copier Service Manual</i>	070-4815-00
<i>4692 Color Graphics Copier Device Driver Development Guide</i>	070-4818-00
067-1204-00 4692 Threshold Voltage Pattern Generator Test Fixture (includes manual)	067-1204-00
067-1204-00 4692 Threshold Voltage Pattern Generator Test Fixture Instruction Manual	070-5123-00
Parallel Interface Cable, 3m (9.8 ft)	012-0518-00
Parallel Interface Cable, 30 ft (9.1m)	012-0527-00
Media Input Tray (for Paper or Transparency)	436-0172-01
Media Output Tray (for Paper or Transparency)	436-0189-00
Copy Counter (to be installed by qualified service personnel)	650-1722-00
Vacuum Port Covers	200-3103-01
Replacement Power Cords	
Standard USA cord	161-0066-00
Option A1	161-0066-09
Option A2	161-0066-10
Option A3	161-0066-11
Option A4	161-0066-12
Option A5	161-0154-00
Fuses	
3.2A Slowblow (for 100V to 120V copiers)	159-0026-00
1.6A Slowblow (for 220V to 240V copiers)	159-0003-00

ACCESSORIES AND SUPPLIES

SUPPLIES

Ink Jet Copier Paper, each package contains 500 sheets.

A-Size 8.5x11.0 in (216x279 mm)	016-0793-00
---------------------------------	-------------

A4-Size 8.3x11.7 in (210x297 mm)	016-0794-00
----------------------------------	-------------

Ink Jet Copier Transparency Film, each package contains 100 sheets.

A-Size 8.5x11.0 in (216x279 mm)	016-0765-02
---------------------------------	-------------

A4-Size 8.3x11.7 in (210x297 mm)	016-0766-02
----------------------------------	-------------

NOTE

The 100 sheet paper packets and 10 sheet transparency film packets in the Option 03 and Option 04 Supplies Startup Kits are only orderable with the initial copier order.

Replacement Ink Jet Cartridges (200 ml). The four colors are:

Cyan	016-0713-01
Black	016-0714-01
Yellow	016-0715-01
Magenta	016-0716-01

NOTE

First shipment copiers can also use ink cartridges with a -00 suffix. The -01 cartridges will be available early in 1985.

Replacement Maintenance Liquid Cartridge (250 ml).

016-0770-00

OTHER RELATED DOCUMENTATION

The following copier labels have user information. If damage to the label occurs, use the listed part numbers to order new labels.

<i>4692 Operators Guide</i> (a label in the consumables access door)	334-5834-00
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<i>4692 Media Loading Instructions</i> (a label on the Media Input Tray)	334-5830-00
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Appendix B

COPIER OPTIONS

INTRODUCTION

The following provides a list of the options available with the 4692 copier. The color copier options are listed in Table B-1.

Table B-1
4692 OPTIONS

Option No.	Description
01	A4 Media Size Version
02	Four-Channel Multiplexer
03	A-size (English) Supplies Start-up Kit
04	A4-size (metric) Supplies Start-up Kit
A1	Power Cord- EURO 220V
A2	Power Cord- UK 240V
A3	Power Cord- AUST 240V
A4	Power Cord- N.A. 240V
A5	Power Cord- SWISS 220V
52	Power Cord- ordered by description
N1	Warranty plus nine month maintenance coverage (for the End User Customer)
N3	Twelve month maintenance coverage (OEM purchasers)

4692 OPTION 01 — METRIC SIZE

This no-cost option modifies the copier to handle metric sized (A4) media. Except for the following changes, the Option 01 copier is the same as the standard copier:

- The drum assembly is modified to handle A4-size media.
- The input tray is adjusted to hold A4-size media.

4692 OPTION 02 — FOUR-CHANNEL MULTIPLEXER

This option allows up to four copy signal sources to connect to the copier at the same time. These sources may be Option 09 or 19 color copier interface equipped Tektronix terminals, Tektronix 4510 series rasterizers, host mainframes with a suitable device driver, or non-Tektronix color terminals (with a device driver analogous to the Option 09 or 19). Option 02 can be installed in conjunction with any other copier option.

OPTION 03 — A-SIZE SUPPLIES STARTUP KIT

The A-size supplies startup kit may only be ordered with the initial purchase of the standard (English version) copier. This option consists of the following:

- Four ink cartridges (one each of black, cyan, magenta, and yellow)
- One maintenance liquid cartridge
- 100 sheet package of A-size paper
- 10 sheet package of A-size transparency film

OPTION 04 — A4-SIZE SUPPLIES STARTUP KIT

The A4-size supplies startup kit may only be ordered with the initial purchase of the Option 01 (metric version) copier. The kit consists of the following:

- Four ink cartridges (one each of black, cyan, magenta, and yellow)
- One maintenance liquid cartridge
- 100 sheet package of A4-size paper
- 10 sheet package of A4-size transparency film

COPIER OPTIONS

4692 OPTION A1

This Universal European 220 volt option provides a 1.6A line fuse and a power cord for operation from 220 volt, 50 or 60 Hz lines.

4692 OPTION A2

This United Kingdom 240 volt option provides a 1.6A line fuse and a power cord for operation from 240 volt, 50 or 60 Hz lines.

4692 OPTION A3

This Australian 240 volt option provides a 1.6A line fuse and a power cord for operation from 240 volt, 50 or 60 Hz lines.

4692 OPTION A4

This North American 240 volt option provides a 1.6A line fuse and a power cord for operation from 240 volt, 50 or 60 Hz lines.

4692 OPTION A5

This Swiss 220 volt option provides a 1.6A line fuse and a power cord for operation from 220 volt, 50 or 60 Hz lines.

4692 OPTION 52

This option allows the customer to define their own power cord and voltage requirements.

Appendix C

MOVING OR STORING THE COPIER

INTRODUCTION

This appendix provides the information necessary for preparing the copier for either a short or a long move and checking out the copier once you complete the move. A short move occurs when the copier does not have to be repacked in a shipping container. A long move occurs when the copier must be shipped in its original packing container, or a substitute container.

This section also provides instructions to prepare the copier for storage. The copier may be stored for up to two weeks following the regular power-down procedure. You may continue storage by powering-up and then powering-down the copier at two week intervals.

THE SHORT MOVE OR STORAGE

The following describes the steps you must follow to move the copier a short distance (even from one end of a table to the other). The steps you follow to prepare the copier for a short move are the same steps you use to prepare the copier for storage.

PREPARING THE COPIER FOR A SHORT MOVE OR STORAGE

1. Press the copier's POWER OFF switch and wait for the POWER indicator to go out.
2. Unplug and remove the copier's power cord and any interface cables.

At this point, the copier may be left unused for up to two weeks. At the end of two weeks, the copier should be powered-up and then powered-down. The copier should be powered-up and down every additional two weeks to assure optimum performance.

MOVING THE COPIER

Use two people (one on each side of the copier), to lift and position the copier. Do not tip the copier more than 10° to avoid spilling fluids inside the maintenance station of the copier. A rolling cart is recommended for longer distances. To protect the ink-jet heads during the move, do not allow excess copier vibration or sudden jarring shocks.

RESTORING THE COPIER TO OPERATION

1. Ensure the copier is level. If not, make appropriate corrections to the surface on which the copier rests to level the copier.
2. Attach the copier's power cord and required interface cable(s).
3. Plug the power cord into a power outlet. Ensure the outlet's line voltage is the same as the previous copier's location.
4. Press the copier's POWER ON button and wait for the READY indicator to light.
5. Momentarily press the TEST button to print a test pattern.
6. If printing quality is poor, press the PURGE button and wait for the READY indicator to light.
7. Repeat Step 5 and examine the test copy for acceptable quality. It may be necessary to purge the copier up to two more times to achieve proper quality.

The copier is ready for normal operation.

THE LONG MOVE

For a long move the copier must be prepared and then placed in a shipping container (preferable the original shipping carton).

PREPARING THE COPIER FOR A LONG MOVE

To prepare the copier for a long move, you must secure the head carriage drive belt to prevent the ink-jet heads from moving while in transit. In addition you must remove the ink and maintenance fluid cartridges.

PREPARATION FOR SHIPMENT

1. Press the copier's POWER ON button (if not already turned on). Allow the copier to initialize (the READY indicator lights steady).
2. Press the copier's PURGE button.
3. Wait for the READY indication to light, then press the copier's POWER OFF button. When the ready light goes out, remove and package the power cord.

CAUTION

For Steps 4 through 6, DO NOT move the head carriage assembly from its capping position.

4. To prevent movement of the head carriage assembly, secure the carriage drive belt clamp (004-2589-00) with cable ties to the carriage drive belt as shown in Figure C-1.
5. Wrap the head carriage with a sheet of absorbent towel to absorb any fluid from the head maintenance station — see Figure C-1.
6. Remove all unused media from the media input tray. Tape the plastic media cover to the tray and reinstall the empty tray into the copier. The media must be shipped or stored separately.

7. Remove the ink and maintenance fluid cartridges (hold an absorbent towel under the cartridges to catch any loose drops). Tape the "needle ports" on the cartridges to prevent any leakage. Package the cartridges and ship or store separately.
8. Tape the top cover door and consumables access door to prevent their opening during shipment.
9. Remove and package the copier's interface cables.
10. Remove and package the media output tray.

Continue with the following procedure to place the copier into the shipping container.

PLACING THE COPIER IN THE SHIPPING CONTAINER

1. Using two people, lower the copier into the shipping container.
2. Place the two foam spacers (if available) on the sides of the copier. If the foam spacers are not available, use suitable substitutes.
3. Place the package containing the cartridges, interface cable(s), power cord, and output tray into the shipping container.
4. Place the lid on the shipping container and secure it in place with shipping bands or reinforced tape.

The copier is now ready for shipment.

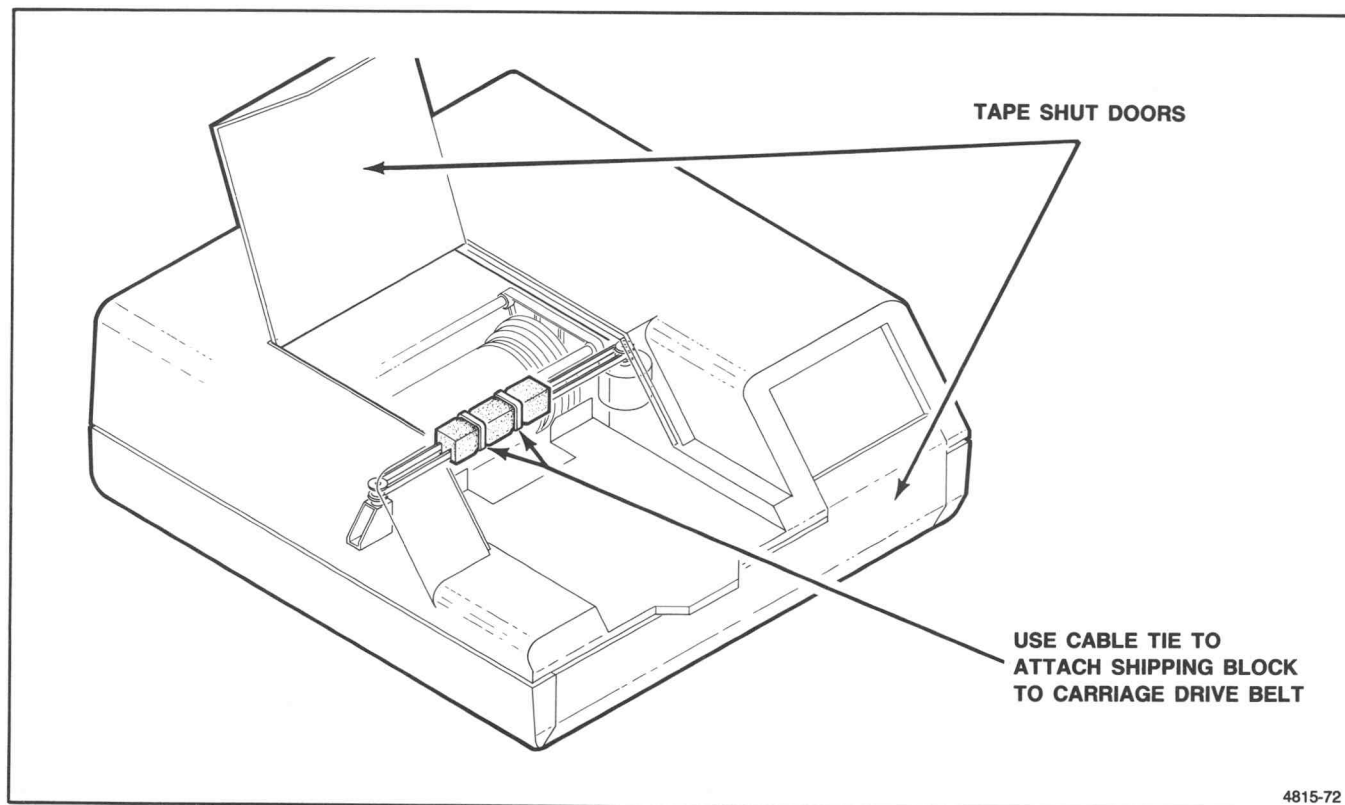


Figure C-1. Preparing the Copier for a Long Move.

Appendix D

INSTALLING THE COPIER

INTRODUCTION

This appendix provides information to initially install a new copier. To install the copier you must:

- Inspect the placement site of the copier
- Unpack the large shipping carton
- Unpack the smaller enclosed accessory package
- Prepare the copier's mechanical assemblies
- Install the required fluid cartridges into the copier
- Set the copier's line voltage
- Check the line fuse
- Connect the interface cable(s)
- Purge the ink lines (if necessary)
- Perform the first time operation and functional check

INSTALLING THE COPIER

PLACING THE COPIER

The copier should be located in an area free of dirt, dust, and corrosive gases. Before positioning the copier, consider temperature, humidity, excessive vibration, and power source stability. See Appendix I, *Specifications* for additional information on environmental needs.

PLACEMENT

Allocate adequate space for unrestricted access to the front, and rear of the copier. A recommended minimum clearance is shown in Figure D-1. Leave room to open the consumables access door and top cover door. Make sure the copier is level to 1.0°.

VIBRATION AND SHOCK

Excess physical shock and vibration can introduce air bubbles into the ink-jet heads. Make sure the copier is located on a solid work surface. When moving the copier, always use the procedures outlined in Appendix C, *Moving or Storing the Copier*.

TEMPERATURE AND HUMIDITY

Recommended operating conditions for the copier require a temperature range of 59 to 95°F (15 to 35°C) and a relative humidity range within 15% to 85% (maximum wet bulb temperature of 22°C). Operation outside these temperature and humidity ranges decreases the copier's performance. Below freezing temperatures may damage the ink-jet heads. Humidity in excess of 85% increases ink-drying time on the printed copy (possibly making the image smear) and may cause media handling problems due to media curl.

POWER SOURCE

The copier requires a reliable and stable power source with minimum fluctuation in voltage and frequency. The copier must be operated on a single-phase power source with one of its current-carrying conductors connected to Safety Earth (ground potential). Operation from power sources having both current-carrying conductors live with respect to ground is not recommended since only the line conductor has over-current (fuse) protection within the instrument.

The copier is designed to operate on a 100, 120, 220, or 240 volt nominal-line voltage source with a frequency of 50 to 60 Hz. The ac power connector is a three-wire polarized plug with one lead connected directly to the instrument frame to provide electric shock protection. Connect this plug only to a three-wire outlet equipped with a safety ground. If the unit is connected to any other power source, the copier frame must be connected to a safety ground system. If necessary, replace the power cord only with another of the same type.

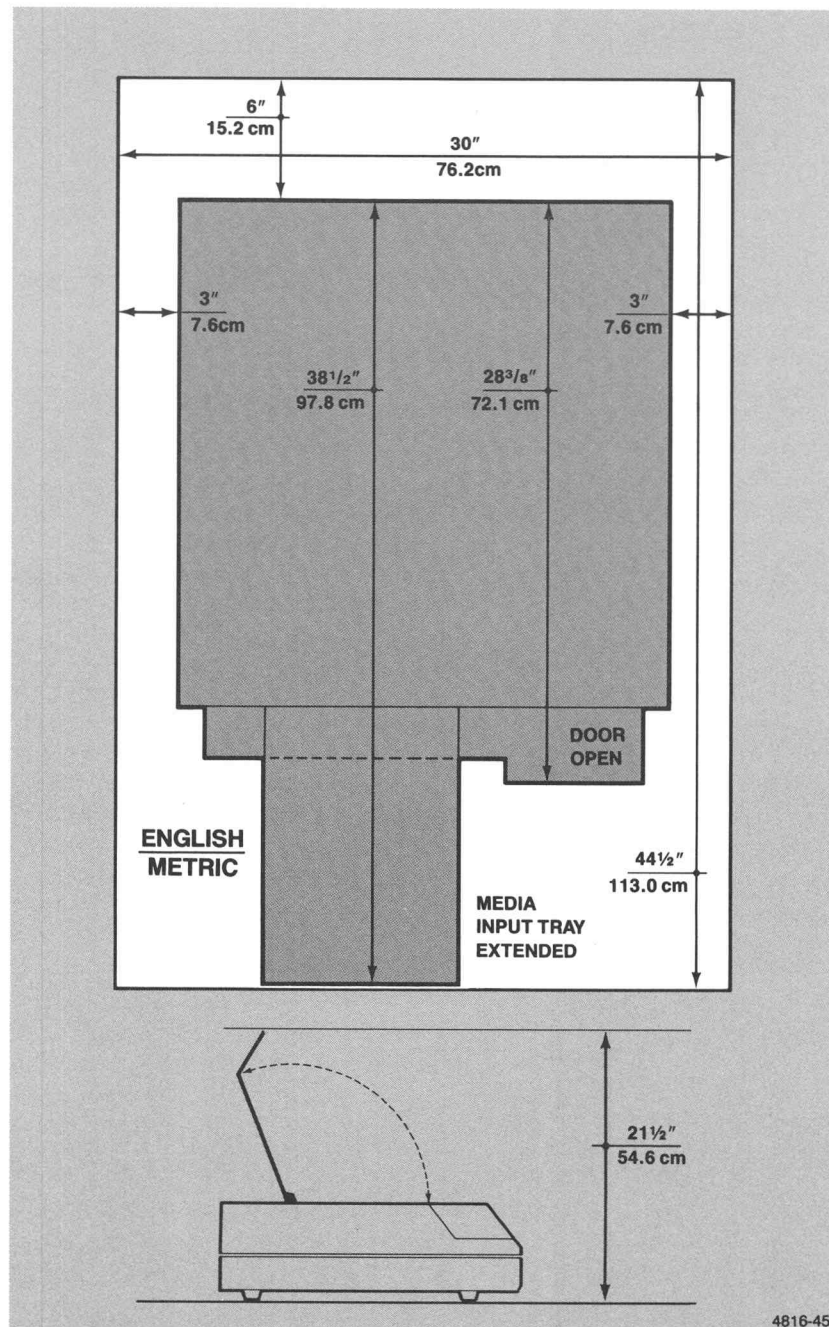


Figure D-1. Minimum Copier Clearances.

UNPACKING THE COPIER

The copier will arrive in a cardboard shipping container. To unpack the copier, you must open the large shipping carton and remove the smaller enclosed accessory package.

UNPACKING THE SHIPPING CARTON

Use this procedure to inspect the copier for physical shipping damage. Figure D-2 shows an exploded view of the shipping container and its parts. All shipping containers and internal packing material should be saved for reuse.

Immediately upon arrival, inspect the container for possible damage incurred during shipping. Report any obvious container damage to the carrier company and to your Tektronix Sales representative.

The following procedure details the steps for removing the exterior shipping carton parts. The step numbers in this procedure correspond to the numbers called out in Figure D-2.

1. Remove the securing bands holding the outer lid on the shipping carton.
2. Lift the outer carton lid straight up and off the shipping carton.
3. Remove the accessory box from the top of the open shipping carton. Set this box aside to be unpacked later.
4. Remove the two foam spacers from the sides of the copier.
5. The copier can now be lifted out of the shipping carton and be placed in its permanent location.

CAUTION

DO NOT attempt to operate the copier at this time, otherwise severe instrument damage will occur.

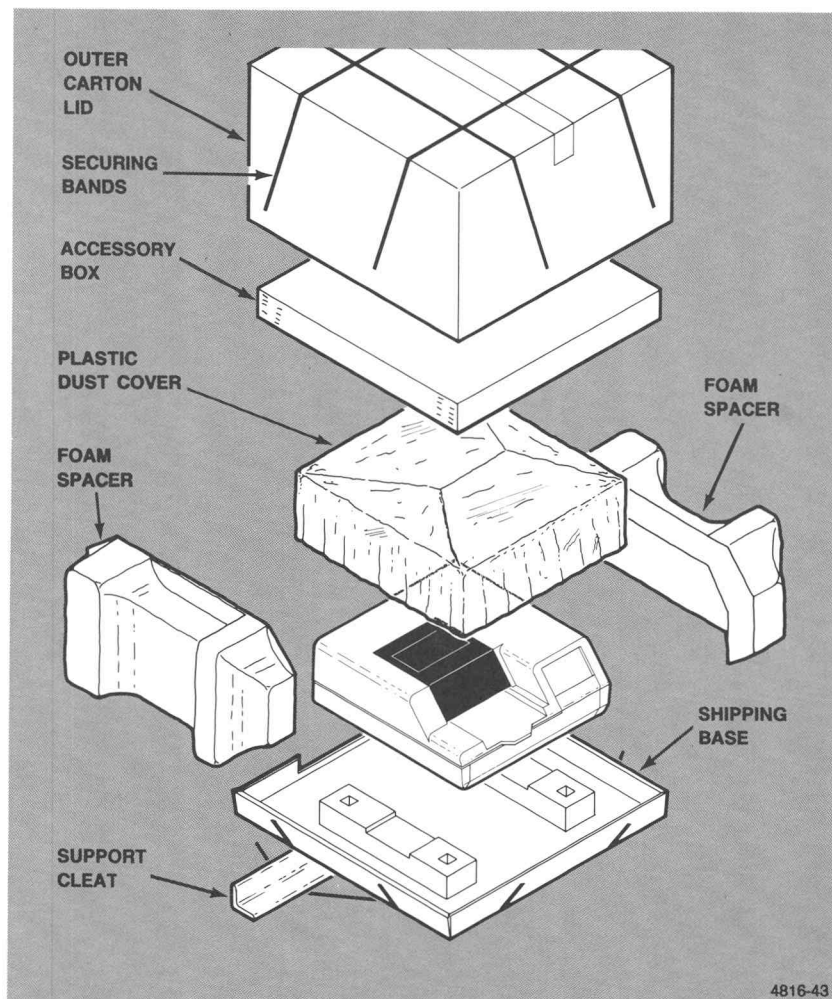


Figure D-2. Exploded View of Shipping Carton.

INSTALLING THE COPIER

6. Figure D-3 shows an exploded view of the accessory package. Upon opening, this package includes the following:

- A 4692 Color Graphics Copier Operators Manual
- A copier power cord
- ~~A media input tray~~
- A media output tray

A startup kit is optionally available and may be included in the package. In this case, the package will also include:

- Four ink cartridges (one each of black, cyan, magenta, and yellow)
- A maintenance liquid cartridge
- Starter packages of paper and transparency film

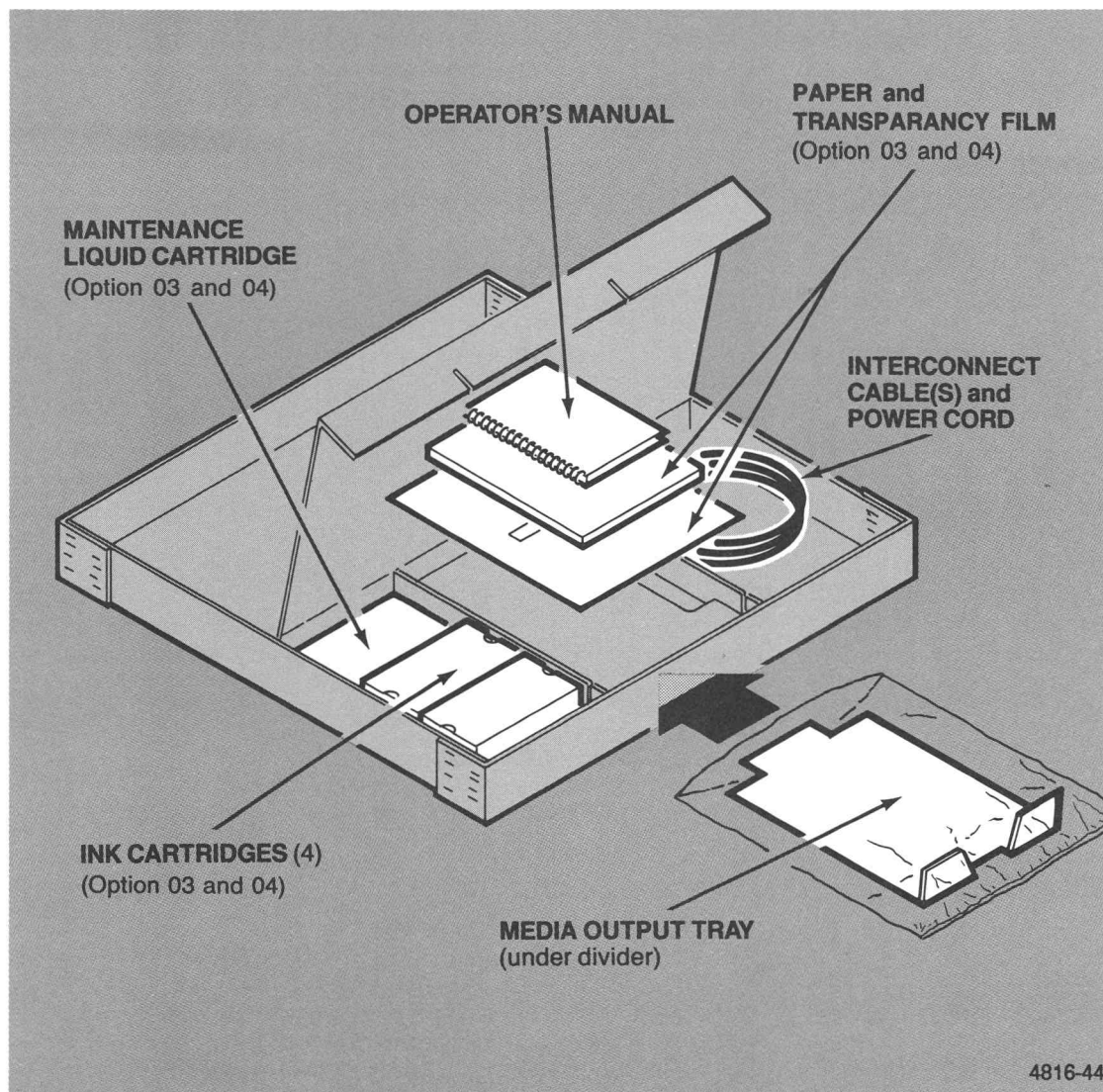


Figure D-3. Exploded View of Accessory Package.

PREPARING THE COPIER FOR OPERATION

CAUTION

DO NOT apply power to the copier at this time.

Perform the following actions to the copier before applying ac power.

Freeing the Carriage Drive Belt

Remove the carriage drive belt clamp from the carriage drive belt — see Figure D-4. Remove any absorbent material from around the head carriage.

Installing Cartridges and Trays

Perform the following four steps:

- Install the four ink cartridges into their proper location. Be sure to remove the adhesive strip from the rear of each cartridges — refer to Section 4, *Ink and Media* of the operators manual.
- Install the maintenance liquid cartridge. Be sure to remove the adhesive strip from the rear of the cartridge — refer to Section 5, *Operator Maintenance and Troubleshooting* of the operators manual.
- Install the media output tray and adjust its length for the proper media size — refer to Section 4, *Ink and Media* of the operators manual.
- Remove the tape securing the plastic media cover to the media input tray. Load media into the media input tray and then install the loaded media input tray into the copier — refer to Section 4, *Ink and Media* of the operators manual.

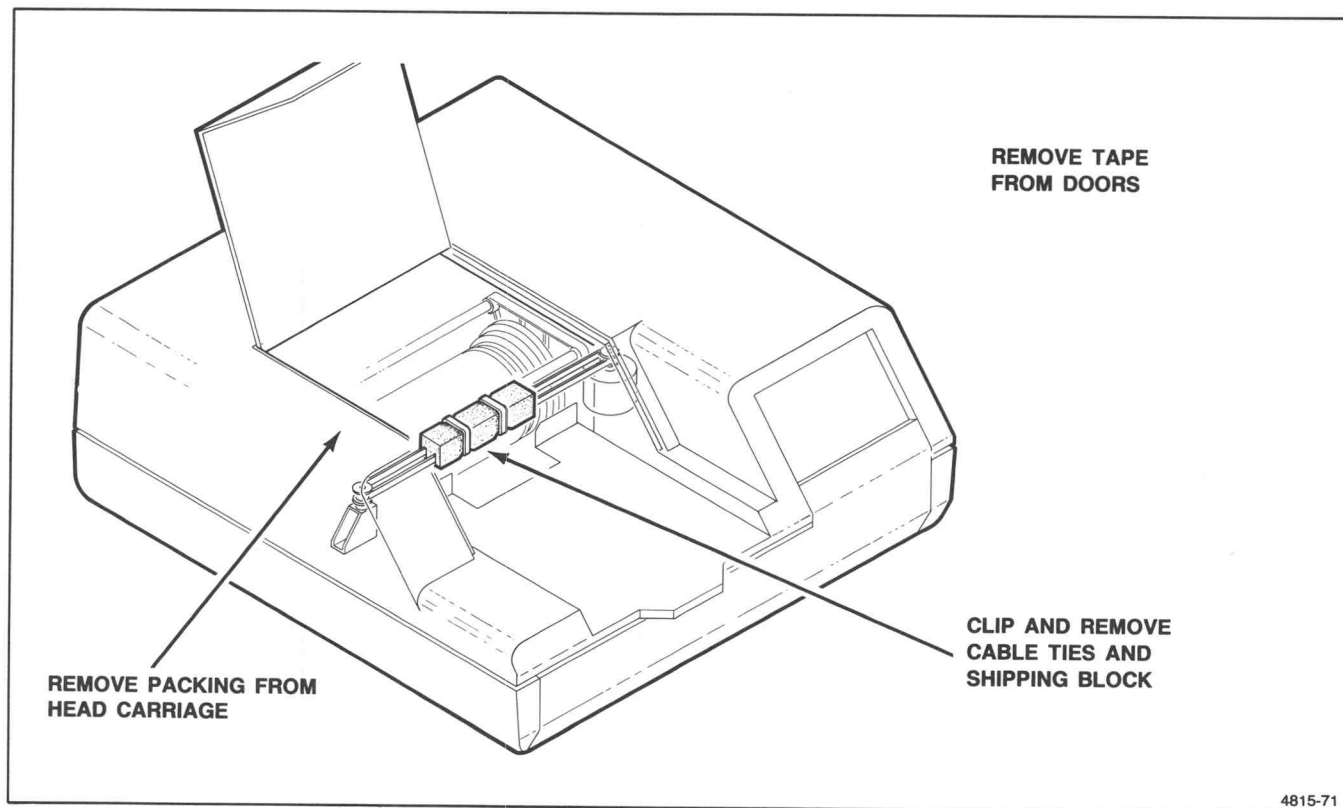


Figure D-4. Freeing the Internal Copier Assemblies.

SELECTING LINE VOLTAGE AND LINE FUSE

STANDARD POWER SETTING

The standard factory power setting for the copier is 120 volts. There are also five power options (A1 through A5) that configure the copier for operation with different ac power environments and outlets. See Appendix B, *Copier Options* for descriptions of each option.

LINE VOLTAGE SELECTOR

The Line Voltage Selector chooses the operating voltage for the copier and contains the line fuse. See Figure D-5 for the selector's location on the copier. Table D-1 gives the Line Voltage Selector settings, operating voltage ranges, operating frequency ranges, and proper line fuse values.

Table D-1

LINE VOLTAGE SETTINGS, RANGES, AND FUSES

Line Voltage Selector Setting	Operating AC Voltage Range	Operating Frequency Range	Copier Fuse Value
100 Volts	87 – 107 Volts	50 – 60 Hz	3.2 A
120 Volts	104 – 128 Volts	50 – 60 Hz	250VSlowblow
220 Volts ^a	191 – 235 Volts	50 – 60 Hz	1.6 A 250V
240 Volts ^b	209 – 250 Volts	50 – 60 Hz	Slowblow

^a Requires 4692 Options A1, or A5.

^b Requires 4692 Options A2, A3, or A4.

To set the copier for a different line voltage, perform the following procedure:

1. Power-down the copier and remove the power cord (if connected) from the Line Voltage Selector.
2. Using a small flat screwdriver, place the tip into the pry spot located on the top of the selector (see Figure D-5).
3. Gently twist the screwdriver to pop open the Line Voltage Selector cover.
4. Open the cover to the horizontal position to expose the voltage selector cam and the copier's line fuse holder.

CAUTION

Never attempt to rotate the voltage selector cam with your fingers. Rotating the cam will damage the voltage selector pins behind the cam. You must always remove the cam to set a new line voltage.

5. Reach into the Line Voltage Selector and pull out the voltage selector cam.
6. Locate the desired line voltage on the cam.
7. Reinstall the cam into the Line Voltage Selector so the desired line voltage will appear in the window of the cover.
8. At this time, compare Table D-1 with your fuse value and replace it if necessary.
9. Close the cover over the Line Voltage Selector. It clicks when properly shut. Check that the desired voltage setting appears in the cover window.
10. Connect the power cord to the copier and a suitable power outlet.

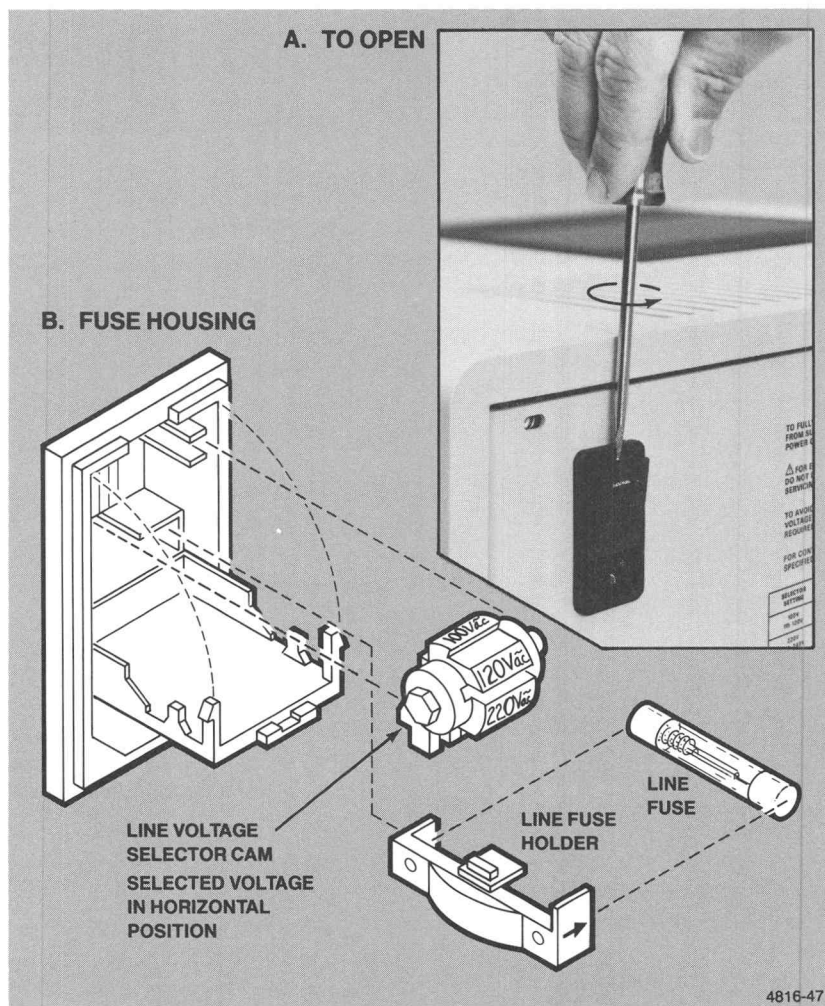


Figure D-5. Line Voltage Selector.

CONNECTING INTERFACE CABLES

The copier communicates with its driving device (either a color terminal, a rasterizer, or a host computer) through the copier's interface port(s) at the rear of the copier. The standard copier has one port while the Option 02 copier has four multiplexed ports. Each port consists of a 36-pin connector that connects to either a 3 meter or 10 meter interface cable. The other end of the interface cable connects to that specific port's driving device.

NOTE

4113B, 4115B, or 410X color terminals must have Option 09 or 19 installed before using the copier.

NOTE

The standard interface line termination provides for series termination of driven signals. It assumes the connected device uses this same termination scheme. If a parallel termination scheme (lower noise) is desired, then jumpers and resistor paks must be moved — refer to Appendix E, Jumpers and Parallel Interface Termination.

The parallel termination configuration is generally used for cable lengths greater than 10 meters (30 feet), but may be used for shorter lengths.

The series termination configuration is compatible with most "standard" TTL parallel interfaces but may experience noise problems if used with cable lengths greater than 10 meters.

Ensure that both the copier and host terminations are of the same configuration or serious signal degradation can occur. Place a tag on any port connector whose termination has been changed, so it will be remembered.

FIRST TIME OPERATION AND FUNCTIONAL CHECK

Make sure the following procedures were performed on the copier:

- The carriage drive belt clamp was removed from the carriage drive belt — see Figure D-4.
- The four ink cartridges and the maintenance liquid cartridge were installed. Ensure any adhesive tape was removed from the inserted end of each cartridge.
- The media input tray was loaded, adjusted for the proper media size, and installed in the copier.
- The media output tray was set to the proper media size.
- The interface(s) cables were connected to the copier.
- The copier is plugged in.

Perform the following steps to power-up the copier:

1. Press the front panel POWER ON switch. The copier will perform a 20-second self-test and ink-jet head maintenance routine.
2. Following the maintenance routine, the front panel READY indicator lights. If it does not, refer to Table D-2.

PURGING THE INK SUPPLY LINES

If the copier is being installed at a site whose altitude is greater than 2000 feet, then the ink supply lines must be purged. Higher altitudes allow air bubbles to degas from the ink. Purging the ink out prevents these bubbles from ever reaching the ink-jet heads. Following this procedure greatly enhances long-term copier reliability.

Refer to the procedure in Section 4.4.2, "Purging the Ink Supply Lines" for the steps to perform this procedure.

CLEARING THE ITS BUBBLE TRAP

Inspect the Initial Transient Suppressor (ITS) bubble traps to determine if they require purging. If a bubble trap are more than 30% full of air, then it requires purging. Refer to the procedure in Section 4.4.2, "Purging the ITS Bubble Trap".

COPIER VERIFICATION

After the copier correctly powers up and is purged, perform the following paper, transparency, and interface tests to check copier operation:

For Paper Printing

1. Open the consumables access door.
2. Make sure there is paper in the media input tray.
3. Verify that the PAPER/TRANSP switch (hidden by the consumables access door) is in the PAPER position.
4. Press and hold the copier's TEST button. Release the button when the PORT 1 indicator lights to select the STRIPES test pattern for printing. The copier should:
 - a. Light the PORT 2, 3 and 4 indicators and extinguish PORT 1 when TEST is released.
 - b. Pick up a sheet of paper.
 - c. Load the paper on the drum.
 - d. Rotate the paper at high speed without any flapping noises from the paper. (If flapping occurs, IMMEDIATELY press the copier's STOP COPY button. Then refer to "Troubleshooting Checklists," later in this appendix.)
 - e. Print Test Pattern 2. Refer to Appendix K, "Copier Test Patterns" for illustrations of the operator accessible test patterns.
 - f. And finally, unload the printed copy into the media output tray.

Refer to Table D-2 and D-3 if copy problems or poor copy quality occurs.

For Transparency Printing

1. Open the consumables access door.
2. Install a sheet of transparency film (with an accompanying separator sheet) on top of the paper in the media input tray. Ensure the transparency film is on top.
3. Set the PAPER/TRANSP switch to the TRANSP position.
4. Remove any paper copies from the media output tray.
5. Press and hold the copier's TEST button. Release the button when the PORT 1 indicator lights to select the STRIPES test pattern. The copier should:
 - a. Light the PORT 2, 3 and 4 indicators and extinguish PORT 1 when TEST is released.
 - b. Pick up the sheet of film.
 - c. Load the film on the drum.
 - d. Rotate the film at high speed without any flapping noises. (If flapping noises occur, IMMEDIATELY press the copier's STOP COPY button. Then, refer to "Troubleshooting Checklists" (later in this section).
 - e. Make a copy containing all the basic colors. Following the printing process, the drum spins for an additional 60 seconds to allow the transparency copy to dry.
 - f. Unload the printed transparency copy into the media output tray.
 - g. Pick up the separator sheet from the media input tray and unload the sheet into the output tray.
6. Reset the PAPER/TRANSP switch to the PAPER position.

If these tests succeed, the color printing and mechanical parts of the copier are operational. If the tests are not successful, make sure the PAPER/TRANSP switch was set to the proper position. Also refer to Tables D-2 and D-3.

Interface Check

To check the copier interface, perform the next set of listed checks using a TEKTRONIX 4115B Option 09 or 19, or a 4113B Option 09 series terminal, or an equivalent image source.

1. Connect the copier's interface cable to the 36-pin connector at the rear of the color terminal. The connector is called "Option 09 TO 4690 SERIES COPIER."
2. Once the copier is connected, obtain the desired color display on the terminal screen.
3. To print a copy of the display, press the HARD COPY key on the terminal's keyboard.
4. Check that the copier prints a color copy of the display.

If this test succeeds, the copier interface and the color terminal are operational. If the test is not successful, (1) make sure the copier's READY indicator is lit, or (2) verify that the terminal's color hard copy interface is selected rather than the monochrome hard copy interface.

For more information on using Tektronix color terminals with the copier, refer to Section 3 of the operators manual. Also refer to the terminal's operators manual and to the *4110 Series Command Reference Manual*.

Table D-2
WON'T MAKE COPY CHECKLIST

Symptom	Probable Solution(s)
Copier does not operate and front panel indicators do not light READY Indicator does not light	<p>Check that the power cord is plugged in.</p> <p>Unplug the power cord and check the line fuse on the rear of the copier.</p> <p>Turn copier's POWER switch off and then back on. If READY still does not light, refer to Section 2 of this manual.</p> <p>Check that the copier's top door is closed.</p>
MEDIA Indicator with FAULT lit	<p>See "Loading Paper" procedure in the operator's manual.</p> <p>Check that media input tray is properly installed.</p> <p>Media input tray is empty. Refill tray with paper or transparency film.</p>
INK LOW Indicator lit with FAULT lit	<p>Use "Replacing Ink Cartridge" procedure in the operator's manual.</p> <p>Gently push in and downward on cartridges to make sure they are properly inserted and locked in place.</p> <p>If a new ink cartridge was just installed, check that any sealing tape was removed from the rear of the cartridge.</p>
MEDIA Indicator flashing with FAULT lit	<p>Check media input tray for improper loading or a media jam.</p> <p>Check media input tray for wrinkled or folded paper.</p>
FAULT Indicator lit	<p>If another status indicator is lit in combination with FAULT, press the TEST button for an extended error code. The error codes are described in Appendix J, <i>Error Codes</i>.</p>
Printing operation does not begin when copy is initiated	<p>Make sure connector cables are secured properly at both ends.</p> <p>Check that the INK LOW, MAINT, MEDIA, and FAULT indicators are not lit. If lit, go to appropriate procedure.</p> <p>Attempt to print one of the copier's test patterns. If it is successful, check the host, terminal, or interface cables or refer to Programmers Reference Guide.</p>

(continued)

Table D-2 (cont)
WON'T MAKE COPY CHECKLIST

Symptom	Probable Solution(s)
Copier loads two sheets at same time	<p><i>Press the STOP COPY button!</i> Remove the two sheets from the copier. Insure the media is correctly stacked in the tray and the printing side faces down. Carefully fan the sheets without folding or damaging them. Reload the media in the tray and check that the media length adjustment is not too loose. Install the tray in the copier and print a new copy.</p> <p>Ensure the fluffer assembly adjustments are correct as well as the media adjustments. Ensure the input tray is not overfilled.</p> <p>If media sits in an extremely humid area, the copier's ability to pick up sheets may be adversely affected due to media curl. If this occurs, use a different package of media until the humid media dries out (24 hrs).</p> <p>Ensure media is all of the same length.</p> <p>Replace the media in the media input tray (the media is either defective or not of the right type.)</p>
Copier prints wrong size image or image is not centered	Check media input tray for proper media size. Make sure the A/A4 slide switch is set for the size of media in the tray. Check the selection of image format parameters at the host interface.
Media misfeed (media does not load onto drum)	Check that media is properly loaded and no wrinkled or folded media is in the input tray. Ensure the media tray is correctly positioned as well as the tray adjustments.
Media jam or noisy operation (on drum)	A media misfeed may occur if the media is flawed, the drum's vacuum did not secure the media, or the drum's vacuum port covers have been set for the wrong media size. If this has happened, open the top cover door and carefully remove any wrinkled media from the copier. Check for proper drum vacuum port cover installation for either A-size or A4-size media. If media flapped against the heads, check copier operation by printing a test pattern.
Media does not exit properly	<p>Check media output tray to see if something is blocking the media path.</p> <p>Check media output tray for too many printed sheets (a maximum of 50 paper sheets or 25 transparencies (with separator sheets) is recommended).</p>

(continued)

Table D-2 (cont)
WON'T MAKE COPY CHECKLIST

Symptom	Probable Solution(s)
Ink smeared on front of media	Open top cover door and inspect drum. If dirty, refer to the cleaning procedures described in Section 4. Also see Table D-3.
Poor copy quality	Check that correct media is being used. If ink problems occur with one specific color, press the copier's PURGE button and let the copier sit for two minutes. Then continue with normal copier use. A purge cycle runs the air and ink at high pressures while driving the heads with a swept frequency. A head wash cycle is performed at the end of the cycle. You may need to repeat the process several times. Also refer to Table D-3 for help with ink and copy problems.
Wrong test pattern or printed copy	Press the STOP COPY button to prevent further printing. After the printed copy goes into the media output tray, attempt to print the desired test pattern.

Table D-3
POOR COPY QUALITY CHECKLIST

Symptom	Probable Solution(s)
Ink smeared on trailing edge of copy	Check for wet ink on the drum assembly. See if the copy is wet (if so, check the media as described further in this table).
Missing lines, unfinished lines, or line squiggle	Check if the copier is subjected to excessive vibration. Purge the copier.
Wet copy or blurred image	Check for wrong media, or if media's printing surface was correctly placed face-down in the media input tray.
Ink colors do not converge properly (overlap)	Print the Convergence Test Pattern. If lines do not align correctly, perform the convergence procedure.
Wrong picture orientation on copy	Check the host or terminal command used to make the copy.
Copy colors are pale or incorrect	Check for an ink cartridge in the wrong slot. If a cartridge is incorrectly positioned, perform the "Replacing Ink Cartridge" procedure in Section 4 of the Operators manual. Check for wrong media, or if media's printing surface was correctly placed face-down in the media input tray.

Appendix E

JUMPERS AND PARALLEL INTERFACE TERMINATION

INTRODUCTION

This appendix provides a list of the selectable features internal to the copier. This includes a list of the jumpers for the Option 02 Four Channel Multiplexer. This appendix also includes the procedure to change the Parallel Interface board's host interface termination.

JUMPERS

Table E-1 provides a list of all available copier jumpers.

Table E-1
LIST OF JUMPERS

Board	Jumper	Purpose When Installed
DRIVE MODULE	TEST PON	Reset TEST Activate power supply
PARALLEL INTERFACE	J512 J517 J717 J718	Parallel termination for FAULT Parallel termination for BUSY Parallel termination for IR/SO Parallel termination for ACK
(OPT 02) PARALLEL INTERFACE PORT 2	J514 J515 J715 J716	Parallel termination for FAULT Parallel termination for BUSY Parallel termination for IR/SO Parallel termination for ACK
(OPT 02) PARALLEL INTERFACE PORT 3	J516 J513 J713 J714	Parallel termination for FAULT Parallel termination for BUSY Parallel termination for IR/SO Parallel termination for ACK
(OPT 02) PARALLEL INTERFACE PORT 4	J518 J511 J711 J712	Parallel termination for FAULT Parallel termination for BUSY Parallel termination for IR/SO Parallel termination for ACK

PARALLEL INTERFACE BOARD TERMINATION

The copier's Parallel Interface board port termination (both non-multiplexed and multiplexed versions) is factory set for series termination of cables up to ten meters in length. If cables longer than ten meters are to be used on any port then that port's termination must be changed. The following procedure explains how to change a selected port's termination.

NOTE

Improper cable termination adversely affects data communication integrity.

Port termination assures the proper "impedance matching" of the interface between the host, the interface cable, and the copier. Each port may be individually terminated for the interface cable used at that port and also for the host's current driving capability. Termination is set two ways:

- **Series Termination** — used with interface cable lengths up to ten meters and when the host cannot drive low impedance loads (100Ω).
- **Parallel Termination** — may be used for terminating all cables lengths up to 30 meters and must be used for any cables longer than 10 meters. In using the parallel termination procedure method, the host must be able to drive low impedance loads of 100Ω with an output current of 24mA.

The following provides the procedure to change a factory set series terminated port to a parallel terminated port. To convert a parallel terminated port to series termination, reverse the procedure. For non-multiplexed copiers, the termination procedure applies only to Port 1.

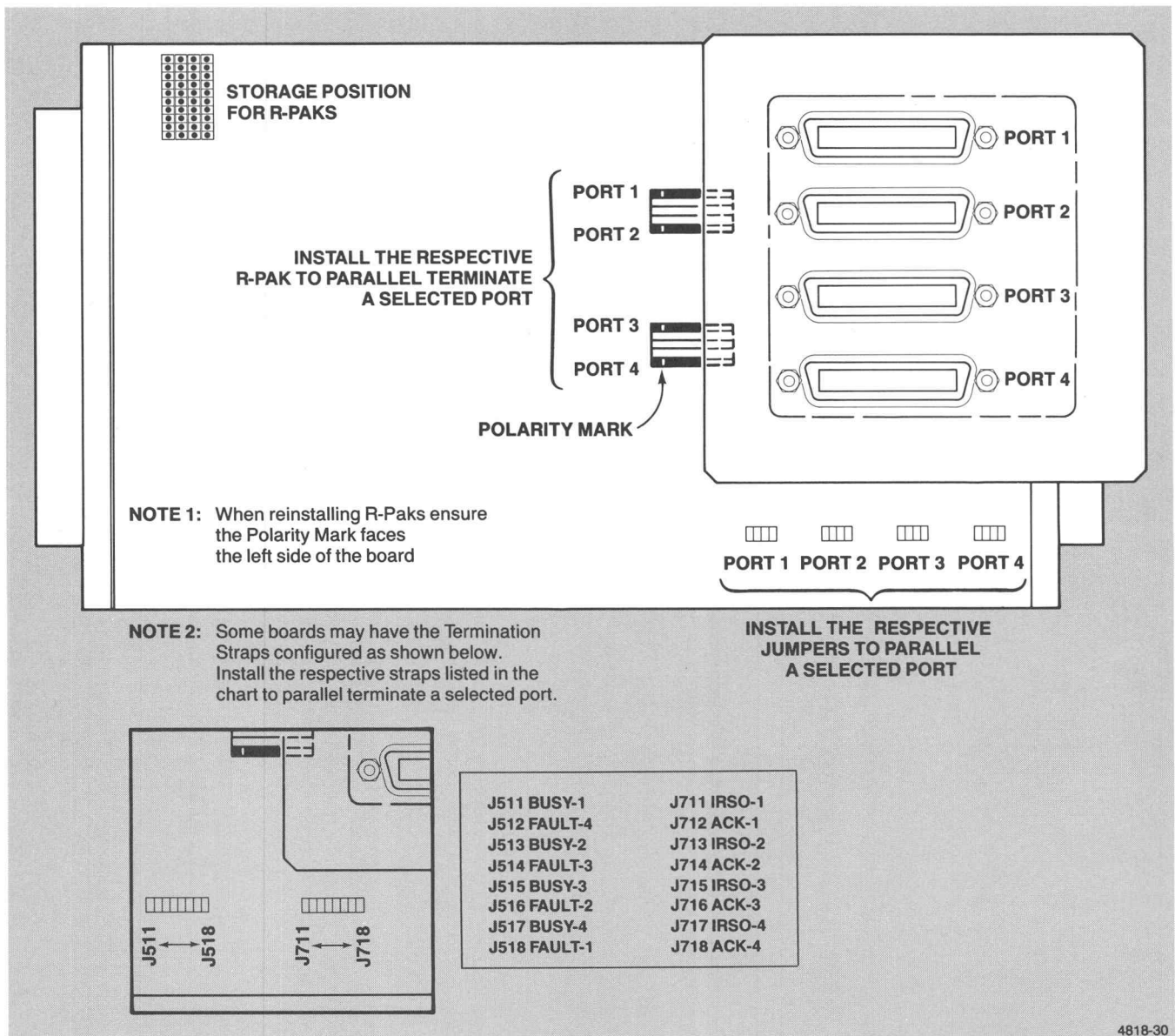
In general, to parallel terminate any port:

- Power-down the copier.
- Remove the circuit board module.
- On the Parallel Interface board, relocate one of the 100Ω termination R-packs from its storage position to specified socket for each port being parallel terminated.
- On the parallel Interface board, change the position of four straps for each port being parallel terminated.

Use the following procedure to parallel terminate any copier host port:

1. Power-down the copier. Wait for the POWER light to go out, then remove the power cord.
2. Following the power-down cycle, remove the interface cable(s) and the top cover (refer to the top cover removal procedure in Section 6, *Mechanical Disassembly/Assembly*).
3. Remove the circuit board module (refer to the circuit board module removal procedure in Section 6, *Mechanical Disassembly/Assembly*).
4. On the Parallel Interface board, locate the R-paks stored in the upper-left corner of the board.
5. Carefully (the R-paks are fragile) remove one R-pak from the storage position for each port being parallel terminated.
6. Referring to Figure E-1, install an R-pak in the respective socket location for each port to be parallel terminated.
7. Referring to Figure E-1, relocate the four respective jumpers to parallel terminate each selected port. While series terminated, a jumper only connects to one pin of a two-pin J-connector. To relocate a jumper to parallel terminate a port, move the jumper from its series terminated position and connect the jumper to both pins of its two-pin J-connector.
8. Verify the placement of all jumpers and R-paks.
9. Reinstall the circuit board module into the copier and replace the copier top cover.
10. Connect the interface cable(s) to the copier. Mark each port for the type of cable each is terminated (parallel or series). The copier is ready for operation.

To series terminate any port, reverse the above procedure.



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Figure E-1. Terminating the Parallel Interface Board.



Appendix F

INTERFACE CONNECTOR AND PROTOCOL

INTRODUCTION

This appendix provides the communication protocol for the TEKTRONIX Parallel Interface. For a more complete description of the interface refer to the *4692 Color Graphics Copier Device Driver Development Guide*.

Table F-1 illustrates the Tektronix Color Copier interface connector's signal and ground pin assignments.

Table F-1

CONNECTOR SIGNAL AND GROUND ASSIGNMENTS

Signal Name	Connector Pin Assignments			Signal Source
	Signal	Return Ground	Shield	
DSTB-0	1	19	a	Host
D0	2	20	a	Host
D1	3	21	a	Host
D2	4	22	a	Host
D3	5	23	a	Host
D4	6	24	a	Host
D5	7	25	a	Host
D6	8	26	a	Host
D7	9	27	a	Host
ACK-0	10	28	a	Copier
BUSY-1	11	29	a	Copier
FAULT-0	32	29	a	Copier
IR/SO	12	—	—	Copier
SLCT-1	13	—	—	Copier

^a All shield lines are connected to the cable connector shell.

INTERFACE PROTOCOL REQUIREMENTS

On power-up both the host and the copier are in an idle state. The interface initiates a self-test of its internal circuitry. If self-test is successful, the READY light on the front panel will illuminate. If the interface self-test failed, a error code is displayed to provide feedback for identifying copier or interface problems.

An eight bit parallel interface (similar to Centronics®) provides the hardware connection between the host and the copier. The list below identifies the signal lines which the host interface must interpret and respond to.

1. D7-D0: Eight data lines for transmitting both command and image data from the host to the copier.
2. DSTB-0: This low active signal informs the copier that the information on the data lines is valid and may be captured by the copier.
3. ACK-0: The copier uses this low active signal to inform the host that the current data has been captured.
4. BUSY-1: The copier uses this signal to inform the host that commands or data may not be sent, or in conjunction with FAULT-0 to indicate that a fatal (hard) fault has occurred.
5. FAULT-0: This signal indicates that an error has occurred. If FAULT-0 is active and BUSY-1 is not, the error is a "soft fault" and the host must begin the transmission over. If BUSY-1 is active, a "hard fault" has occurred and the error must be corrected before another copy can be initiated.
6. IR/SO: This line is used to indicate the image relationship with respect to the media being utilized. Further, during the status request it acts as a bit serial line to transmit status information from the copier to the host.

In the true Centronics® interface this control line indicates, to the host, that the copier is out of paper.

7. SELECT-1: The copier sets this control line high (active) to indicate to the host that the copier is connected and ready. With most other copiers, it only implies that a peripheral is attached to the cable.

Table F-2
COPIER STATUS

Signal Logic Levels ^a		Copier Status
FAULT-0	BUSY-1	
1	0	IDLE — Copier ready for command or data.
1	1	BUSY — Copier not ready for data because media is loading or unloading, servicing another MUX port request, or auto-purging itself.
0	0	SOFT FAULT — Copier detects a recoverable error in the copier or transmission. Terminates current transaction. Begin a new transaction.
0	1	HARD FAULT — Copier detects fatal error and terminates current transaction. Cause of error must be found and corrected before initiating a new transaction.

^a Logic levels are read on the copier interface connector. FAULT-0 is a low-true signal while BUSY-1 is a high-true signal.

NOTE

The host is not required to listen to all of the control lines provided it adheres to the transmission protocol, but copies may be lost with no indication of trouble to the operator.

HOST TO COPIER COMMUNICATION

The required data transmission format for host and copier communication is specified in the "Tektronix Parallel Interface" specification document. The raster data transmitted must be in a RGB (red, green, blue) signal and the host must adhere to one of the following formats.

- Two pixels per byte (1 bit per primary)
- One byte per pixel (2 bits per primary)
- Two bytes per pixel (4 bits per primary)

Allowed data transmission modes are:

- Streaming mode — ACK-0 returned, to the host, at the end of each transmitted raster line of data.
- Handshake mode — ACK-0 returned, to the host, after each data byte transmitted.

Once the copier enters the idle state, it awaits data from any of the input ports. When a DSTB-0 is received, the requesting port lamp will light. The other ports are masked out by asserting BUSY-1 until the copier determines whether the information sent from the "active" port is valid. If the information is valid, the copier awaits the reception of the rest of the data. If the information was invalid, the copier sets a fault condition to the requesting port, releases the remaining ports, and returns the interface to an idle state.

Assuming a valid COPY REQUEST command has been received from a port, the interface awaits the transmission of the copy header data from the host. The copy header data identifies:

- The host resolution
- The mode of data transfer (stream/handshake)
- Image orientation
- The type of raster data format ("n" bits per primary)

Upon transmitting the copy header data, an EOL (end of line) command identifies the end of the copy header. The copier now translates and validates the copy header from the "active" host. If the copy header is valid, the BUSY line is raised to hold the image data and an ACK is returned to the host. If the copy header was invalid the interface processor asserts the FAULT line, clears the BUSY from the other ports, and returns the interface to idle.

NOTE

The FAULT assertion may only be held for a time span of 500ms, before the interface mux will move onto the next port to be polled.

Once a correct copy header has been received and BUSY-1 has been asserted, the print engine loads the media onto the drum, moves the ink-jet heads over to the printing area, and awaits image data from the host. Deasserting the BUSY-1 signal is the prompt for the host to send its first line of raster data. If the host has specified "Handshake" raster data transfer mode, the copier returns an ACK-0 signal after each data byte, indicating it is ready for the next data byte. If the host requested the "streaming" mode of data transfer, the copier returns an ACK-0 after each EOL (end of line) command received from the host. This indicates the end of transmission for that line of raster data, and the copier awaits another line of image information.

If the line of raster data does not contain enough pixel data, the copier "fills" the rest of that line with repeats of the last received pixel. If the line of raster data exceeds the maximum number of pixels per line, the excess number of pixels will simply be truncated and not printed.

When all of the image data has been sent, the last command, following the EOL from the last raster data line, is an EOT (end of transmission) command. The copier then asserts the BUSY-1 line, sends back the ACK-0 to indicate that it has received the EOT command, and proceeds to unload the finished copy. After the paper has been unloaded, the interface deasserts the BUSY-1 signal and return the interface to the IDLE state to await another data strobe (DSTB-0).

The polling scheme is designed to poll all other ports before returning to the releasing port. Thus, in a normal mode of operation each host can produce one copy before the next host requesting service is enabled. This is not true if the host has sent a RESERVE COPIER command. In this case the interface will not return to the idle mode but remains attached to the active host, completing the copy or copies, until the Reserved status is released either because an ABORT command is received, a FAULT condition occurred, or the front panel CLEAR is pressed.

COPIER TO HOST COMMUNICATION

In response to a STATUS REQUEST command from the host, the copier transfers the 14-byte (112-bit) status message data to the host in a bit-serial mode using the IR/SO hardware line. Each data byte is output most significant bit first.

The host places the STATUS REQUEST command byte on the data bus, and activates DSTB-0 (data strobe). The copier responds by placing the most significant bit of the status message's first byte on the IR/SO line, and activating ACK-0 (acknowledge). Upon receiving the ACK-0 pulse from the copier, the host reads the IR/SO line, places a BIT PROMPT command on the data lines, and activates the DSTB-0 line. The copier then responds by placing the second most significant bit of the status message's first byte on the IR/SO line. The host continues to prompt the copier, using the BIT PROMPT bit-by-bit, until the full 112-bit status message is received. The last bit of the status message restores the IR/SO line to reflect the copier's current imaging/media relationship (for the 4692, it will be a logic "1").

NOTE

Remember that the STATUS REQUEST command prompts the first bit of the Status Message from the copier. The BIT PROMPT command prompts all the subsequent bits. Data at IR/SO remains valid from the assertion of ACK-0 to the receipt of the next DSTB-0.

CONFIGURABLE I/O — FRONT PANEL TO PROCESS CONTROL

FA-1

FRONT PANEL ADDRESS differentiates high/low output registers. It may be used to expand the front panel functions to 256 input/output registers by flagging FD0-7 in multiplexed bus applications.

FD0 – FD7

FRONT PANEL DATA is a unidirectional data path between the Process Control and the Front Panel. It may convey address/data information in muxed applications with the inclusion of FA-1 flag bit.

FSTB-0

FRONT PANEL STROBE is a 1 usec (nominally low going) strobe indicating address/data information (FD0-7) is valid.

RST-0

RESET-0 is a buffered RESET signal indicating the power supplies are out of tolerance.

FW-1

FRONT PANEL WRITE determines the direction of the FD0-7 data path. When this signal is asserted, the Process Control is the sending device.

PON-1

POWER ON is a wired “or” signal used for enabling the power converter which generates logic and control signals for the power supplies through the pulse width modulator (U651).

SIGNALS COMMON TO PROCESS CONTROL AND DRIVE MODULE

BD0 – BD7

BUFFERED DATA 0 – 7 is the microprocessor buffered data bus common to all bipolar logic elements.

W10F-0

WRITE STROBE F-0 is a decoded strobe to the Blower PLL (Phase Lock-loop) Servo Drive logic.

W10D-0

WRITE STROBE D-0 is a decoded strobe to the U355 logic decoder.

W10C-0

WRITE STROBE C-0 is a decoded strobe to the Drum PLL Servo Drive logic.

RIOD-0

READ SELECT D-0 is a select signal for reading data out the U355 logic decoder.

RIOC-0

READ SELECT C-0 is a select signal to read the state of the Drum PLL Servo Drive logic.

E-0

ENABLE-0, a buffered enable signal, used as a 1MHz clock, which indicates the microprocessor is in the second half of a machine cycle, the pulse width is approximately 500 nanoseconds. E-0 is used to clock registers/counters for servo drive.

16CK-0

16 × Imaging Clock-0 — This signal is derived from the ink-jet waveform generator and clocks the carriage step motor and drive phase counter. During imaging, the frequency of this clock equals one-third of E-0.

YRATE

YRATE is a scaled 16CK which enables the carriage step motor drive phase counters. The scale factor provides a “programmable lead screw” to establish Y-axis pitch during imaging, and controlled velocity during carriage positioning.

DEN-1

DRUM ENABLE-1 enables the Drum Servo amplifier and Drum Hall Switch feedback registers.

MAJOR SIGNALS

DREF-1

DRUM REFERENCE FREQUENCY-1 — a programmable frequency used by the Drum Phase Lock Loop (PLL) Velocity Servo as a phase/frequency reference.

DSYNC-0

DRUM SYNC-0 — The rising edge of this signal coincides with the media on the drum passing the trajectory of the BLACK ink-jet. It synchronizes the image process to the media position.

BID-0

BLOWER INCREMENT/DECREMENT-0 enables the Blower Servo Velocity Error accumulator to count up or down in response to errors detected in the phase/frequency discriminator.

BINC-1

BLOWER INCREMENT-1, when asserted in conjunction with BID-0, causes the velocity error accumulator to count up.

BVEL-0

BLOWER VELOCITY-0 is a buffered Hall Switch signal from the blower motor. It is used to determine the blower velocity during auto calibration of the vacuum system.

STRIP-1

STRIP ENABLE-1, when active, energizes the STRIP solenoid.

RESET-0

SYSTEM RESET-0, an open collector signal, indicates the power supplies are out of tolerance.

PFAIL-1

POWER FAIL, an open collector signal, indicates that 150msec of energy storage remains until power supply potentials go out of tolerance.

PON-1

POWER ON-1, a “wired or” signal which, when asserted, enables the power converter to generate logic and control power supplies.

BLACK

CYAN

MAGENTA

YELLOW

These four signals are 1.9 volt peak to peak 48 μ sec period gated sinewave ink-jet drive waveforms except BLACK which is a 2.2 volt peak to peak signal.

AGND

ANALOG GROUND — This provides ground path for analog circuits on Process Control board originating on Drive Module board. AGND ties to system ground only at the Drive Module board.

IMAGE DATA CONTROL SIGNALS FROM PROCESS CONTROL PIA 2

PCD0 – PCD6

PATTERN COMPENSATION DATA is a bi-directional bus providing direct access to the ink-jet drivers during purge and Service mode (output data) and for evaluation of Image Data Path functionality during diagnostics (input data). PCD0 – PCD6 are inputs during imaging.

CA1 PFAIL-1

POWER FAIL-1, when asserted indicates approximately 150 msec of power reserve before RESET asserts. The CA1 interrupt is defined for leading edge detection, and PFAIL-1 allows the processor to evaluate the PFAIL-1. A PFAIL-1 interrupt should only be enabled after media loads and the drum is at imaging velocity.

TSTCK-0

TEST CLOCK-0 allows the processor to step the Image Data Path reference waveform/timing generator under program control for diagnostic evaluation of the DMA data path.

IJEN-0

INK-JET ENABLE-0, when asserted, allows the multiplying DACs, which modulate the ink-jet drive waveform, to output their signals to the ink-jet drive amplifiers. IJEN-0, when asserted, also enable the primary to parallel registers to assemble the data output by the Pattern Compensation ROM. See Table H-1.

PCEN-0

PATTERN COMPENSATION ENABLE-0, while deasserted, allows the processor to access the inputs of the primary to parallel format registers through PC0 – PC6 and activate the ink-jets under program control. When enabled in conjunction with both IJEN-0 and DIEN-0, the copier is ready to process an image. See Table H-1.

DIEN-0

DITHER ROM ENABLE-0, when asserted, places Dither ROM data at port 1 of the microprocessor regardless of whether the Image Data Path is imaging or in diagnostics. While deasserted, the microprocessor can access the Spatial Normalization, History and Pattern Compensation block through its port 1. See Table H-1.

Table H-1
ENABLE SIGNAL COMBINATION EFFECTS

IJEN-0	PCEN-0	DIEN-0	U131 Fout	Effect
1	1	1	X ^a	Image Data Path disabled.
1	1	0	TSTCK	DMA/Dither ROM Test.
1	0	1	TSTCK	Spatial Normalization, History Register, Pattern Compensation ROM Test.
1	0	0	E/3	IDP enabled, the Ink-jets disabled; used to flush History and Spatial Normalization registers.
0	1	1	X ^a	Illegal State
0	1	0	E/3	Processor access to inkjets for head fill, flush, or level set.
0	0	1	E/3	Allows imaging on media without interface board. Data is input after Dither ROM from processor.
0	0	0	E/3	IDP enabled, ink-jet enabled, ready to image. If scan line is enabled then DMA request is issued and carriage motion is enabled on positive going BLANK-0. First dot printed one DOTCK later.

^a X means DON'T CARE

BWI-0

BLACK WHITE INVERT-0, when asserted, allows comparator to evaluate incoming pixel data for all zero (black) or all ones (white). If they are detected, the black ink dither data is complemented.

RES0, RES1

RESOLUTION BITS 0, 1 allow normalization of ink dot density as a function of the programmed resolution. At lower resolutions (dots per inch), the ink-jet drive voltages are increased to create larger dots on the media. This maintains a consistent optical density on all printed images. Four dot sizes are addressed by the two bits. The largest dots size (addressed by both bits being low) are produced when the resolution is at 128 dots per inch. The smallest dots size (addressed by both bits being high) are produced when the resolution is at 158 dots per inch.

DY0, DY1

DITHER CELL ADDRESS 0, 1 The color indexed pixel data received from the Parallel Interface identifies a cell array in the four primary planes of the Dither ROM. Each cell within an array is identified by two bits for each axis (x and y). The two-bit x address is generated by a counter clocked at a DOTCK rate initialized at the beginning of each scan line. The two-bit y address is incremented by the microprocessor as a part of scan line enable responding to the BLANK IRQ signal.

CB1 BLANK IRQ

BLANKING PULSE INTERRUPT, a pulse synchronized to the rotation of the drum, indicates when enabled, when the non-printing portion of the drum is exposed. BLANK IRQ triggers on the falling edge of BLANK-1. The processor uses this time to "arm" for the next scan line.

CB2 SLE-0

SCAN LINE ENABLE-0, triggered by the restoration of BLANK IRQ, allows the "arming" of the Image Data Path as a function of DY0 and DY1. SLE-0 remains high during copier idle and diagnostics modes.

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Appendix I

SPECIFICATIONS

INTRODUCTION

The information in this section details all operational specifications required to ensure proper performance of the copier. The following specifications are provided in this appendix:

- Environmental characteristics
- Functional characteristics
- Electrical characteristics
- Mechanical characteristics
- Physical characteristics

PERFORMANCE CONDITIONS

This information assumes the conditions outlined in the following list are observed. The copier's performance limits specified in this section require the following conditions:

- Locate the copier in an environment conforming to the limits described in this section.
- Allow the copier to warm up for 10 minutes and run two copies of Test Pattern 1, before checking specifications.
- Under extreme humidity conditions the printing media may require up to 24 hours to equilibrate for proper loading and unloading.

SPECIFICATIONS

ENVIRONMENTAL CHARACTERISTICS

Table I-1 lists the environmental characteristics and performance requirements for the copier.

Table I-1
ENVIRONMENTAL CHARACTERISTICS

Characteristics	Performance Requirements
TEMPERATURE	
Operating-Paper	59 — 95°F (15 — 35°C)
Operating-Film	59 — 86°F (15 — 30°C)
Non-operating	32 — 122°F (0 — + 50°C)
ALTITUDE	
Operating	0.89 kg/m ³ minimum air density (approximately 0 — 8,000 feet at 20°C.
Non-operating	0 — 15,000 feet pressure altitude.
VIBRATION	
Operating	Less than 0.25g with less than 0.010 inches displacement. Some image quality impairment may occur during exposure to these vibration levels, when the copier is printing.
NOISE	
During Printing	Less than or equal to 56 dba sound pressure level at the bystander position per ISO/DP 7779.
MAXIMUM TILT	1.0° from horizontal plane.
HUMIDITY	
Operating-Paper	15 — 85% relative humidity.
Operating-Film	20-70% relative humidity.
Non-operating	10 — 95% relative humidity.
	All values are noncondensing, with maximum wet bulb temperature of 25°C (for paper) and 22°C (for transparency).

(continued)

Table I-1 (cont)
ENVIRONMENTAL CHARACTERISTICS

Characteristics	Performance Requirements
PAPER	
Operating	Same as copier.
Storage Conditions	In cool, dry, dark location with original packaging or other wrapper.
Storage Time	One year from date of shipping.
INK	
Operating	Same as copier.
Storage Conditions	0 — 21°C. (in cool, dark location).
Storage Time	Two years from filling at factory.
TRANSPARENCY FILM	
Operating	Humidity Range restricted 20 — 70% Maximum wet bulb temperature 22 °C.
Storage Conditions	Temperature range restricted 15 — 30°C.
Storage Time	In cool, dry, dark location with original packaging or other wrapper. One year from date of shipping.
HEAT DISSIPATION	184 BTU's/hour (figured at a 20% copying cycle and 80% idle time).

FUNCTIONAL CHARACTERISTICS

Refer to Table I-2.

Table I-2
FUNCTIONAL CHARACTERISTICS

Characteristic	Specification
Printing Process	Air assisted drop-on-demand ink-jet
Inks	Water-based, non-toxic (cyan, magenta, yellow, and black)
Basic Reproducible Colors	Seven colors (magenta, yellow, cyan, red, green, blue, and black) plus the color of the paper (white)
Half-tone Colors (using dot patterns)	208 color patterns available
MEDIA TRAYS	
Input Tray	A/A4-Size Tray (100-sheet capacity)
Output Tray	A/A4-Size Tray (50-sheet capacity)
Copy Time	1 to 2 minutes (longer if slow data transmission occurs from host data source)
Multiple Copies	Without Operator Intervention Paper — Up to 50 copies Film — Up to 25 copies
Image Format	Landscape (horizontal) or Portrait (vertical) are selectable under program control. See <i>4692 Color Graphics Copier Device Driver Manual</i> , the terminal operators manual or command reference guide
Maximum Image Dimensions	A-Size — 9.95 x 7.50 inches (253 x 190mm) A4-Size — 9.95 x 7.27 inches (253 x 185mm) Images may be smaller in one or both axes
Addressability	Variable dots/inch (depends upon media size and image specified) For A-size — 128 dpi to 154 dpi For A4-size — 128 dpi to 159 dpi
Resolution	Horizontal Resolution = 1536 pixels maximum Vertical Resolution = 1152 pixels maximum

ELECTRICAL CHARACTERISTICS

Refer to Table I-3 for voltage, fuse, power, and emissions specifications.

Table I-3
COPIER VOLTAGES AND FUSES

Item	Specification
Line Voltage	Four ranges can be set: 100 Vac — 87–107 Vac, 50–60 Hz 120 Vac — 104–128 Vac, 50–60 Hz 220 Vac — 191–235 Vac, 50–60 Hz ^a 240 Vac — 204–250 Vac, 50–60 Hz ^a
Power Consumption	360 watts (maximum — during media load) 110 watts (during printing) 35 watts (during copier idle)
Fuse Selection	87–128 V 3.2A 250 V (slow-blow) 191–250 V 1.6A 250 V (slow-blow)
RF Emissions	Meets or exceeds specifications for FCC Part 15, Sub J, Class A.

^a Requires one of Options A1 through A5, which include different fuses and/or power cords.

MECHANICAL CHARACTERISTICS

Refer to Table I-4 for mechanical specifications.

Table I-4
MECHANICAL CHARACTERISTICS

Characteristic	Specification
Copier Initialization Time	30 seconds or less if no error conditions are encountered.
Media Supply System	Automatic sheet feed, vacuum media pickup, 100-sheet capacity on media input tray.
Media-Size Conversion	Uses a movable spacer bar in the media input tray and detent positioners in the media output tray The drum's vacuum port covers change position when modifying copier between A-size and A4-size media.
Media Transport	Rotating drum holds paper by vacuum suction.
Media Unloading	Automatic, using gravity stacking in media output tray. Media output tray capacity is 50 sheets (media curl during humidity extreme conditions may reduce media output tray capacity).

SPECIFICATIONS

PHYSICAL CHARACTERISTICS

Refer to Table I-5 and Figure I-1 for physical specification of the copier, ink cartridges, and maintenance liquid cartridge.

Table I-5
PHYSICAL CHARACTERISTICS

Characteristic	Specification
SHIPPING	
Weight	90lbs (41 kg)
Transit	Meets National Safe Transit Committee Test procedures
COPIER	
Size	Refer to Figure C-1 – Height 8.5 in (216mm) – Width 24.0 in (610mm) – Length 24.0 in (610mm)
Weight	70 lbs (32 Kg) includes trays
Safety	Meets UL 144, UL 478, CSA 154, IEC 435, and IEC 380 Standards

(continued)

Table I-5 (cont)
PHYSICAL CHARACTERISTICS

Characteristic	Specification
INK CARTRIDGE	
Weight	12.5 ounces (350 grams)
Ink Capacity	6.8 fluid ounces (200 ml)
MAINTENANCE LIQUID CARTRIDGE	
Weight	17 ounces (470 grams)
Fluid Capacity	9.0 fluid ounces (250 ml)

Appendix J

ERROR CODES

COPIER ERROR CODES

The copier can report internal and external error conditions to an operator or service technician. Reportable errors consist of the following types of problems:

- Operator mistakes such as leaving the top cover open.
- Conditions within the copier that need operator attention, such as the copier running out of ink or media or a media misfeed occurring.
- Conditions outside the copier that may compromise copier operation, such as an excessively low ac line voltage at the power outlet.
- Copier electrical, mechanical, or interface malfunctions.

ERROR CODES

HOW ERROR CODES ARE PRESENTED

The copier signals an error condition when the FAULT indicator lights steadily. The copier presents the specific error code in two ways using the copier's front panel indicators:

- By using the four PORT indicators to give five possible error conditions for the operator. The operator's error code report occurs when the copier is either in Normal mode or in Test mode.
- By using combinations of the INK LOW and PORT indicators to provide an extended error code. You access the extended error code report by pressing TEST when an error occurs.

Only one error code is presented unless the operator/technician asks for the extended error code by depressing the TEST switch). The copier always presents the error code for the first error encountered in cases where multiple error conditions exist.

OPERATOR ERROR CODES

The operator error codes are presented in a simple format using the four PORT indicators on the copier's front panel. Each lit PORT indicator represents a copier problem (where the PORT-4 indicator represents the least significant digit of the error code while the PORT-1 indicator represents the most significant digit of the error code) — see Table J-1.

ERROR LISTING

Table J-1 presents the five operator error codes and what they mean.

Table J-1
OPERATOR ERROR CODES^a

Error Code (HEX)	PORT Indicators				Copier Condition	Assumptions
	PORT 1	PORT 2	PORT 3	PORT 4		
0	off	off	off	off	Operational	No error
1	off	off	off	ON	Copier fault	Either an electronic, mechanical, or an interface fault has occurred. — For more information, perform an extended error code check by pressing TEST.
2	off	off	ON	off	Low ac line voltage	Ac line voltage to the copier is too low.
4	off	ON	off	off	Carriage was not parked correctly	Carriage not in cap position at power-up, or at some other unexpected time.
8	ON	off	off	off	Door Open Fault	The top door is open.
15	ON	ON	ON	ON	Interface error	While the copier was busy, a host attempted to access the copier.

^a Only one error code will be displayed at a time. This error will be the first recognized as a fault and any printing or testing in progress will be aborted.

EXTENDED ERROR CODES

The copier's extended error codes are presented in a hexadecimal format using the four INK LOW indicators and the four PORT indicators on the copier's front panel. Up to 255 different errors can be represented using the eight indicators. Presently, the copier uses only 42 error codes. The PORT-4 indicator represents the least significant digit of the error code while the Black INK LOW indicator represents the most significant digit of the error code. For example, if all PORT indicators are lit with the Cyan INK LOW indicator, the hexadecimal error code is 8F. Table J-2 presents the functional extended error codes and what they mean.

The extended error codes are organized into six groups:

- **Interface Normal Operating Faults** — These faults may be recovered by operator intervention (pressing CLEAR).
- **Interface System Faults** — These faults indicate a hardware failure with the interface processor communication. These failures are not fatal to system operation.
- **Interface Fatal Hardware Faults** — A failure due to one of these faults stops all system operations except Error Code displays and the power-down routine.
- **Normal Operating Faults** — These faults may be recovered by the operator performing the required function.
- **System Faults** — These faults indicate a hardware failure with the system hardware. These failures are not fatal to system operation.
- **Fatal Hardware Faults** — A failure due to one of these faults stops all system operations except Error Code displays and the power-down routine.

Table J-2 presents the extended error codes and their meanings.

Table J-2
EXTENDED ERROR CODES

INK LOW Indicators				PORT Indicators				HEX Code Value	Error Condition
BL	CY	MA	YE	1	2	3	4		
Indicator's HEX Value									
8	4	2	1	8	4	2	1		

GROUP 1: INTERFACE NORMAL OPERATING FAULTS — operator recoverable

			X	X				1 8	Host wrote through I/F port busy – protocol violation.
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GROUP 2: INTERFACE SYSTEM FAULTS — indicate hardware problems associated with internal processor communications but not fatal to system operation

	X			X		X		4 A	I/F protocol fault – illegal token transmitted from print engine processor.
	X			X		X	X	4 B	I/F protocol timeout fault token not transmitted from print engine processor in the last 120 msec.
	X			X	X		X	4 D	I/F logical record check fault – data garbled or in wrong sequence.

GROUP 3: INTERFACE FATAL HARDWARE FAULTS — lock out all operations except Error Code display and Power-down functions

	X	X	X				X	7 1	I/F ROM self-test fault.
	X	X	X			X		7 2	I/F RAM self-test fault.
	X	X	X		X	X		7 6	I/F buffer self-test fault line buffer/DMA fault. Suspect DMA, data latch, line buffer RAM, or data lines.
	X	X	X		X	X	X	7 7	I/F port self-test fault suspect port flip/flops, PIA, FPLA, or signal noise.
	X	X	X	X				7 8	I/F state machine self-test fault – port state machine failed to clear data strobe. Suspect PIA, FPLA, DMA, line buffers, data latch, color mapping PROM, or data paths.
	X	X	X	X			X	7 9	I/F Unexpected interrupt fault – suspect processor or NMI line.

GROUP 4: NORMAL OPERATING FAULTS — operator recoverable

X			X				X	9 1	Top cover door open fault.
X			X			X		9 2	Fluid fault–empty cartridge.
X			X			X	X	9 3	Media out fault–Tray empty.
X			X		X			9 4	Media fault–paper jam.
X			X		X		X	9 5	Media drum wrap fault.
X			X		X	X		9 6	Ink-jet heads not capped.
X			X		X	X	X	9 7	Recovery fault.

(continued)

Table J-2 (cont)
EXTENDED ERROR CODES

INK LOW Indicators				PORT Indicators				HEX Code Value	Error Condition
BL	CY	MA	YE	1	2	3	4		
Indicator's HEX Value									
8	4	2	1	8	4	2	1		
GROUP 5: SYSTEM FAULTS — indicative of hardware problems but not fatal to system operation									
X	X						X	C 1	Vacuum cal fault—defective vacuum switch or blower velocity out of range.
X	X					X		C 2	Carriage index fault.
X	X					X	X	C 3	Carriage index or vacuum cal fault.
X	X				X			C 4	Carriage index or drum index or vacuum cal fault.
X	X				X		X	C 5	Drum index or vacuum cal fault.
X	X				X	X		C 6	Drum servo fault—drum failed to achieve imaging velocity.
X	X				X	X	X	C 7	Drum stop fault—drum failed to stop. PPL velocity error never passed zero.
X	X			X				C 8	Drum fault—drum velocity out of tolerance.
X	X			X			X	C 9	Vacuum adjust fault—vacuum switch not able to adjust after picking media.
X	X			X		X		C A	Protocol fault—illegal token transmitted from interface processor.
X	X			X		X	X	C B	Protocol timeout fault token not transmitted within the last 120 msec.
X	X			X	X			C C	Interface latency fault interface failed to respond to Blank data request in time for the print engine to rearm for next scan line.
X	X			X	X		X	C D	Logical Record check fault data garbled or in wrong sequence.
X	X			X	X	X		C E	Maximum line count fault too many raster lines sent to the print engine.
X	X			X	X	X	X	C F	Unexpected process fault process unexpectedly timed-out.

(continued)

ERROR CODES

Table J-2 (cont)
EXTENDED ERROR CODES

INK LOW Indicators				PORT Indicators				HEX Code Value	Error Condition
BL	CY	MA	YE	1	2	3	4		
Indicator's HEX Value									
8	4	2	1	8	4	2	1		

GROUP 6: FATAL HARDWARE FAULTS — locks out all operations except Error Code display and Power-down functions									
X	X	X	X				X	F 1	ROM self-test fault.
X	X	X	X			X		F 2	RAM self-test fault.
X	X	X	X			X	X	F 3	Pattern compensation ROM fault.
X	X	X	X		X			F 4	Spatial normalization RAM fault.
X	X	X	X		X		X	F 5	Dither ROM test fault.
X	X	X	X	X			X	F 9	Unexpected interrupt fault suspect processor or NMI line.
X	X	X	X	X		X		F A	Received NULL TOKEN fault print engine received Null command (00) on the serial communication interface or line. Suspect interface processor circuit board interconnect.
X	X	X	X	X		X	X	F B	Transmitted NULL TOKEN fault—print engine transmitted Null command (00) on the serial communication interface or line. Suspect interface processor or circuit board interconnect.

Appendix K

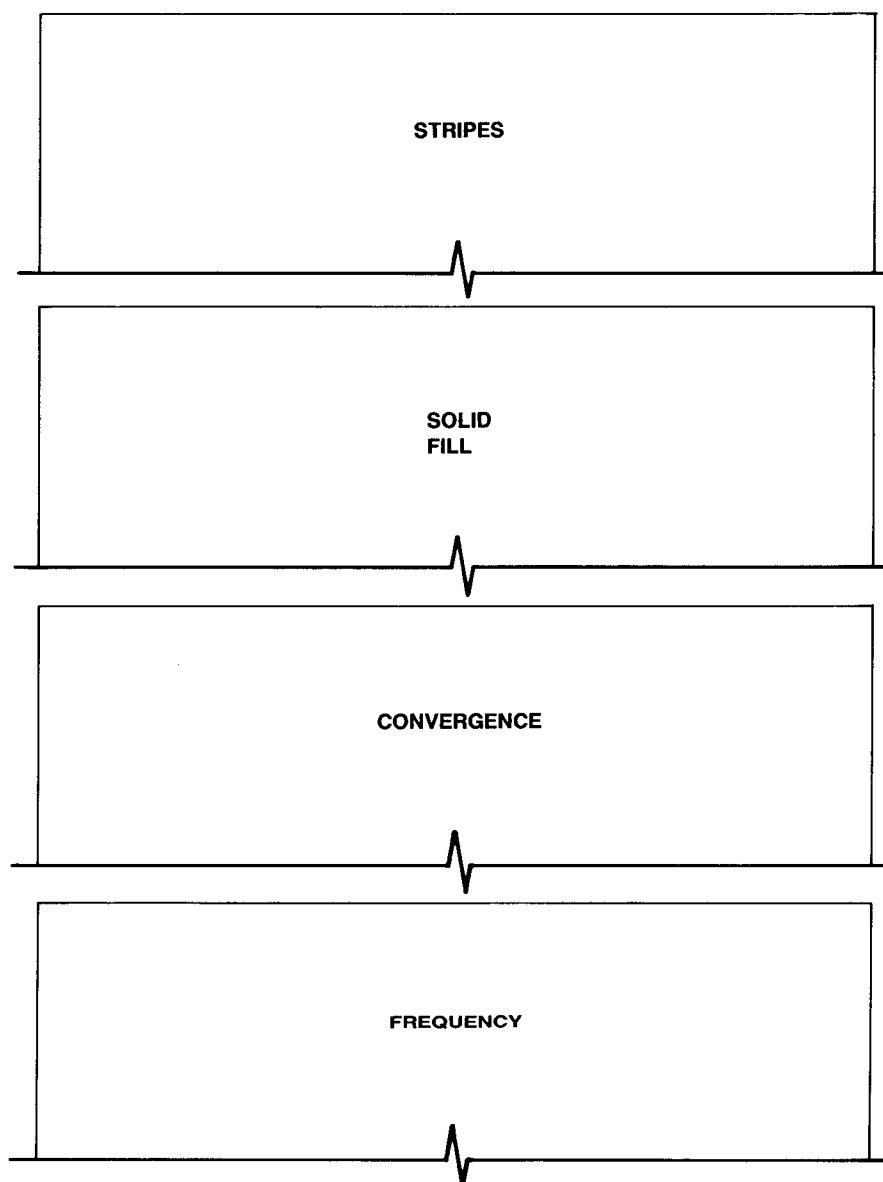
COPIER TEST PATTERNS

This color appendix illustrates the four test patterns stored within the copier.

COPIER TEST PATTERNS

COPIER TEST PATTERNS

The copier stores four internal test patterns shown in Figure K-1. Use the figure to locate a specific test pattern on the color foldout. Using these patterns to identify imaging problems is described in Section 2 — *Problem Identification and Performance Checks*.



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Figure K-1. Copier Test Patterns.

